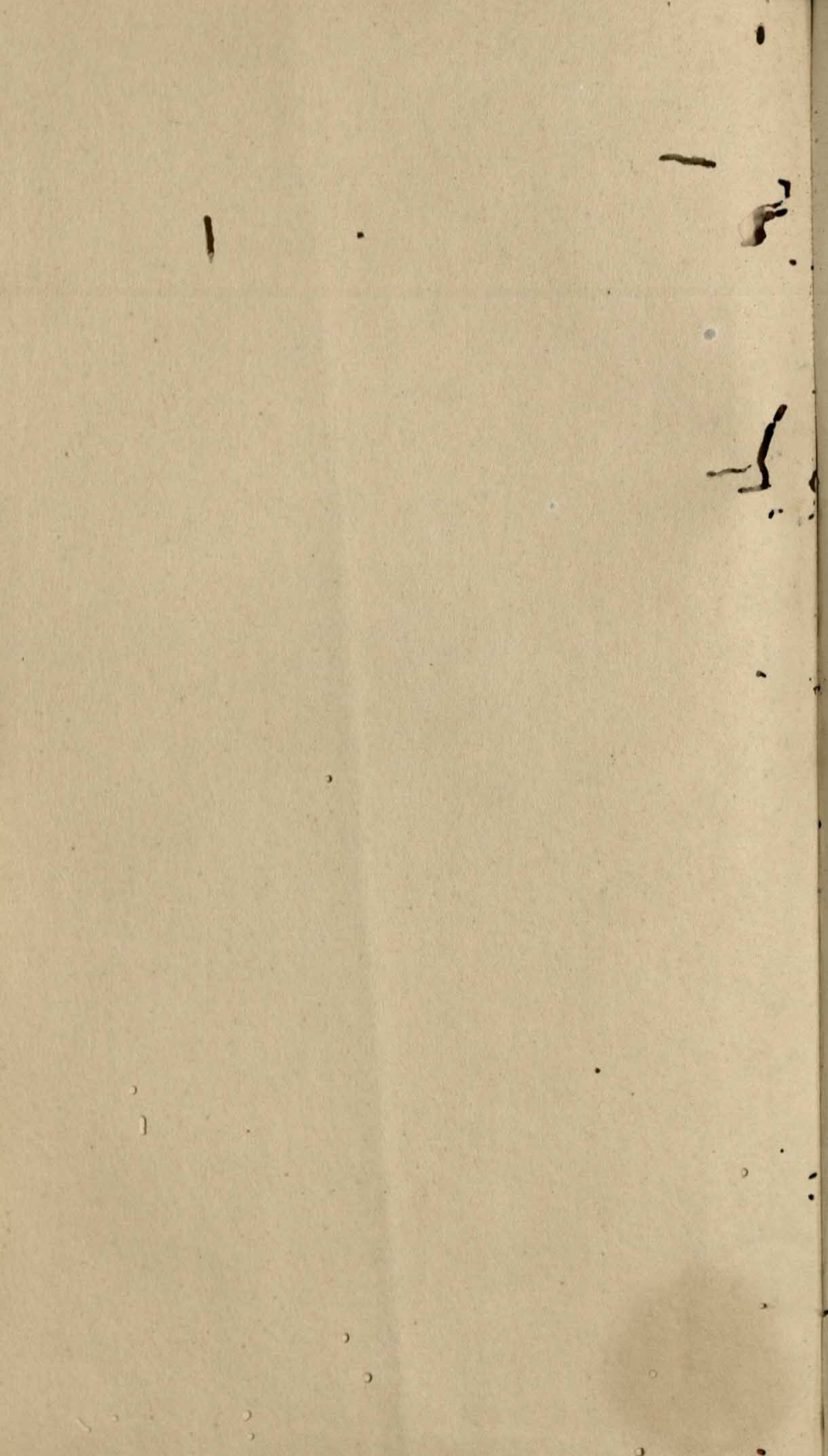


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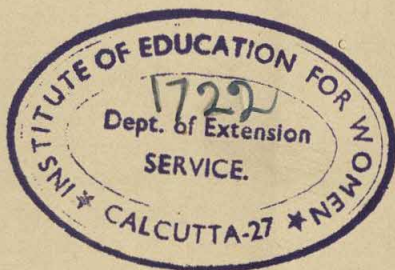


SURVEYS OF
INDIAN INDUSTRIES

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By
BADITHA SRINIVASA RAO
Industrial Correspondent to *The Statesman*

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PREFACE

THIS book is the outcome of a series of surveys of Indian industries which have appeared in *The Statesman*.

There are a few points about these surveys to which I should like to invite attention. The first is that, where there have been important developments, the surveys have been brought as far up to date as rapidly changing conditions permit.

There are a host of separate industries, and much has been written and is constantly being written about them. To supply in two volumes a summary of industries so many and various is a bold undertaking. I lay no claim to completeness but rather have I endeavoured to cover the vast and ever-widening field by a process of selection, elimination and condensation, and with the kind and valuable aid of many representatives of Indian industry. Even so, it has been necessary to leave out much on which it would have been pleasant to dwell.

This is an explanatory work, proceeding on broad lines, rather than a technical treatise. Presentation of the technical aspects must be left to those intimately conversant with them. I have written as an enthusiast. The expert will possibly find the exposition elementary and those who are interested in some particular aspect of these industries — technical or economic — may feel that this has received too little attention. But the general reader, particularly if not rigidly bound by technical tradition, will, I hope, catch something of my enthusiasm as he comes with me on my industrial tour of exploration.

Together, these surveys constitute an attempt to relate a few facts of first importance (e.g. production, imports, exports, distribution and consumption) as accurately as possible. They propound no new theories; they attempt the solution of no problems. They are intended to raise questions, not to solve them; to suggest lines of investigation, not to follow them out to their conclusions. There has been no rambling into economic theory. No judgements have been pronounced on developments in industry. These, however interesting, it was felt, were outside the scope of a survey. That a picture of the past is perhaps the best basis for the understanding of the future is its only justification.

My thanks are due to Mr G. A. Johnson, Editor of *The Statesman*, who encouraged me to undertake an enterprise which was entirely new to me and who has helped me with friendly advice as it proceeded. Hardly less is the debt I owe *The Statesman* for permission to have the surveys published in the form of a book.

In the course of preparation I have had in full measure the help of representatives of the industries concerned and of the Government. In

acknowledgement of the assistance received I tender thanks gratefully. It would be invidious to select organizations and individuals for specific mention and I hope they will accept this general acknowledgement of much assistance readily given.

Likewise I am under obligation to libraries in Calcutta, Delhi and Madras who cheerfully responded to requests for books not readily procurable.

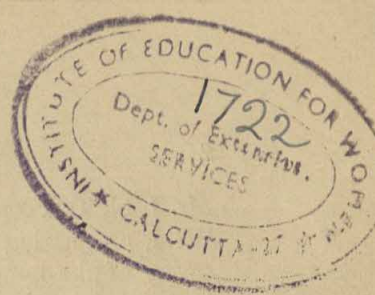
B. S. R.

Calcutta, January, 1957

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Volume Two will contain surveys of the Cotton textile, Jute, Tea, Sugar, Fruit and vegetable preservation, Cement, Ceramics, Glass, Shipbuilding, Shipping, Films and Paper industries.



CHAPTER I^c

THE IRON AND STEEL INDUSTRY

History of Industry

COMMON to most definitions of wealth is J. S. Mill's concept of 'all useful or agreeable things which possess exchangeable value'. Raw material and manpower satisfy these criteria, but, as value appreciates by manufacture, capital, equipment, technical experience and a highly developed organization are required to excavate and develop the material.

In a country where respect for age is part of tradition, claims to remote antiquity are not uncommon. A period of nearly 2,000 years has been claimed for the iron and steel industry; and, relatively speaking, the claim does not seem extravagant. Its history is replete with references to the famous Damascus or Woodze sword, steel for which is said to have been supplied by India.

However genuine such claims may be—and indeed quite a few historians have admitted them—they are of but academic interest to the student of industry. Other than that they give an indication of the bent of native genius and of the potentialities of a people, they are to him of little significance.

Coming to less remote times, the aborigines of Central India and neighbouring areas have been known to smelt ore into iron in small mud furnaces with the aid of wooden bellows for the supply of the necessary blast to produce the metal.

The first recorded attempts made in this country to manufacture iron and steel on a commercial basis were those of Mottee and Farquhar in 1779. They proved abortive. In 1830, one Mr. Josiah Heath, a retired Civil Servant of Madras, attempted to establish a factory at Porto Novo with the monetary assistance given by the East India Company. Due to a number of difficulties, not the least being the death of the founder, the project proved a failure.

The next commercial attempt at producing iron and steel was the Barakar Iron Foundry at Kulti. After a chequered career it passed into the hands of the Barakar Iron & Steel Co., in 1887. Two years later, it was transformed into the Bengal Iron & Steel Co., and in 1919 it came to be known as the Bengal Iron Co. They were the first to produce pig-iron in India on modern lines.

The most outstanding success in manufacturing steel in India on a commercial basis was that of the Tata Iron & Steel Co. Ltd. The late

Mr. J. N. Tata commenced, with the technical assistance of Mr. C. M. Weld, prospecting operations in Bihar in 1903. These led to the discovery of the famous iron belt of India, which contains some of the largest iron ore deposits known to the modern world. The company started its steel works at Sakchi in 1908. Pig-iron was made in 1911 and the first steel ingot a year later. Additions to the plant have been made from time to time. The company is now capable of producing over 7,50,000 tons of saleable steel a year.

The Indian Iron & Steel Co. Ltd. was started in 1918 at Hirapur, about four miles from Asansol Junction on the old East Indian Railway. In 1936, the company absorbed the Bengal Iron Co. Ltd., which operated in Kulti at a distance of about seven miles from Hirapur. After the amalgamation of the two companies, the Steel Corporation of Bengal Ltd. was constituted in 1937 in association with the Indian Iron & Steel Co. Ltd., for the manufacture of steel.

The Tariff Board and the Tariff Commission had recommended on successive occasions amalgamation of the Steel Corporation of Bengal and the Indian Iron & Steel Co., on the ground that it would eliminate duplication and ultimately tend to reduce costs. The amalgamation was effected in January 1953, the amalgamated company being known by the name of the latter unit, which was to take over all the assets and liabilities of the former. The merger was a condition of the expansion scheme approved by the Government of India and the World Bank Mission; that fact, in the context of the need for steel in essential nation-building activities, explains the use of exceptional powers by the Government. The rated finished steel capacity of the company is about 3,50,000 tons.

An iron works was started at Bhadravati in Mysore State in 1921, to which a steel plant was added in 1934. This company came to be known as the Mysore Iron & Steel Works. Its main source of ore supply is the Kemmangudi ore field. The ore is mainly hematite. The company's present annual production capacity is about 25,000 tons of finished steel.

It is also able to produce annually about 1,600 tons of ferro-silicon, an article essential for the manufacture of good-quality steel. In addition, a rod and strip mill for the manufacture of wire rods and baling hoops and a steel foundry for making steel castings required by railways and industrial concerns are in operation. Improvements and additions to the plant are being made by the Government of Mysore.

Industrialization, in the modern sense, can be said to have begun in India in the early fifties of the last century when a few coal companies and cotton and jute mills came into existence. Initially—and understandably too—the pace of progress was slow; and emphasis was on

light industries. Indeed, until the outbreak of World War I, the iron and steel industry was hardly noticeable. The war gave it an impetus that was very necessary at the time. Imports of, among other things, iron and steel became difficult and dependence on local production increased as a result.

With the object of increasing indigenous production, provincial industrial committees and a Munitions Board were established by the Government at the time. An Industrial Commission was also appointed ; but little is known now of the action taken on its recommendations. In 1923, the iron and steel industry, along with a number of other industries like textiles, sugar and matches, came under State protection. A policy of what has come to be known as 'Discriminating Protection' was evolved, and although the advantages that accrued to the industries concerned were not unqualified, yet, on balance, it would appear that considerable progress was achieved during the period of protection. Production of iron and steel, which was about 1,31,000 tons in 1922-3, increased to 10,70,000 tons in 1939-40. There were similar substantial increases in production in the other industries also which had come under protection. The inter-war period could be said to be a significant stage in the development of the iron and steel industry. India came to be ranked among the first eight industrial countries of the world. And with the outbreak of World War II, the iron and steel industry received a further fillip.

There was again a general and urgent demand for Indian iron and steel products ; and to meet the demand new minor plants were laid, new processes were evolved, new lines of production were started and new technical skill was built up. Encouraged by the tariff protection of the home market, individual schemes of expansion were put through by the iron and steel companies. The index of industrial activity (this relates to all industries) rose from 114.0 in 1939-40 to 120.5 in May 1945.

In the final analysis, it would appear that the iron and steel industry owes much of its progress to the protection from foreign competition that it received from the State for nearly 23 years ; that the two world wars were means of acceleration ; and that without this additional productive capacity, irrespective of the manner of its achievement, India might have been still more severely handicapped.

The industry no longer needs protection. It has established itself securely on the soil. Yet, viewed in the large, its present position is not altogether satisfactory. Firstly, it is unable to produce enough to meet national needs. The 'battle of the gap' still continues. India still depends upon other countries for capital equipment ; and her Government has found it necessary to appeal in terms of the utmost

urgency for a united effort to expand production in all branches of industry to achieve economic independence. The country's economy remains largely lopsided. It is not merely that the pressure of population on land is considerable. In industry itself, emphasis is still on the production of consumption goods. The manufacture of capital goods plays only a subordinate part.

Government's Plans for the Industry

The development of the iron and steel industry forms an important part of the Government of India's plans for industrialization. The primary consideration in planning is necessarily to establish and develop those key industries which are indispensable to further industrial development and without which no real progress can be achieved ; the iron and steel industry constitutes one of the main foundations on which the industrial structure of the country can be built.

Its products are the raw material of an extensive group of metal-working and engineering industries. Magnet steel for telegraphs and telephones, high-silicon steel for dynamos, high-speed steel for machine tools and stainless steel for surgical instruments are but a few of its uses. It is required also for the manufacture of munitions. For agricultural implements, utensils and furniture, the use of steel is much too common to need any emphasis. The *per capita* consumption of iron and steel in this country, compared with other countries, is very small. It is only 8 lb. per year in India as against 860 lb. in the U.S.A., 520 lb. in the U.K., and 470 lb. in Australia. That even this small requirement of 8 lb. per year per man is not being fully met from indigenous sources shows how great is the need for expansion.

An Industries Conference was convened by the Government of India in Delhi in December 1947. The conference was of the opinion that almost since the end of the war, but more noticeably since August 1946, there had been a steady decline in industrial production with the result that considerable installed capacity was lying idle ; and that 'the fall in production increased manufacturing costs on the one hand and scarcity of both consumer goods and industrial raw materials on the other'.

This led to the adoption by the Government of India of a comprehensive programme. The immediate objective of all Government planning, it was announced, was to step up existing production in all industries to existing capacity by

- (a) regulating the distribution of raw materials in short supply ;
- (b) facilitating transport ; and
- (c) ending labour unrest by conciliatory measures.

In accordance with this programme, an immediate and a short-term plan were formulated. The former covered a period of 12 to 18 months and applied only to industries which required no fresh capital goods and could carry on with the raw material available.

Short-term plans were spread over a period of three years; and industrial panels were formed by the Advisory Planning Board. The panels fixed the targets for each industry. In regard to steel, installed capacity was taken to be 12,64,000 tons per year; the short-term target was fixed at 15,70,000 tons and the long-term, at $2\frac{1}{2}$ million tons.

Long-term plans were also prepared in regard to various industries by experts appointed by the Planning Department.

According to the Government of India Resolution dated 6 April 1948, the iron and steel industry is one of those industries in which the State—the State in this context included Central, Provincial and State Governments and other public authorities like municipal corporations—will be exclusively responsible for the establishment of new undertakings except where in the national interest the State finds it necessary to secure the co-operation of private enterprise subject to such control and regulations as the Central Government may prescribe.

Machinery was set up at different levels—central, regional and unit—to facilitate the progress of the plan to increase production. At the Centre there is a Central Advisory Council of Industries which covers the entire field of industry and has under it committees for each major industry. An extensive organization representative of all sections of industry has been built up. In its resolution dated 13 November 1949, the Central Advisory Council of Industries stated that the immediate problems to be faced were

1. Increase of production, reduction of cost, and improvement of quality.
2. Increase in the efficiency of labour, management and organization of the industry as a whole.
3. Improvement in the marketing of the products at home and abroad.

The Fiscal Commission 1949-50 stated in their report that 'on a study of the natural and mutable factors of production we conclude that...within the limits set by these factors, the pattern of India's heavy industries will be determined by the natural advantages which its iron and steel industry enjoys'. They added that the broad picture of the development of large-scale industries that emerged from an analysis was briefly as follows :

1. Defence industries.

2. Heavy industries.

3. Heavy basic industries—which provide the foundation of many other capital goods as well as consumption goods industries, e.g. iron and steel industry, machine tools industry, automobiles, tractors and other heavy machinery.

And they placed the iron and steel industry fourth in the order of priorities for the public sector. In the private sector, the Commission accorded 'increase of production in existing undertakings up to the maximum of their installed capacity' the highest priority.

The Report of the Planning Commission contains the following significant passage :

'The production of iron and steel in the country is hardly 50 per cent of the existing volume of demand, and it is evident that in planning the development of a basic industry like iron and steel, account has to be taken not only of immediate requirements but also of the needs of the country over a fairly long period. A high rate of industrial advance cannot be achieved without increasing substantially the production of iron and steel and of aluminium, ferro-alloys, caustic soda and soda ash, fertilizers and petroleum products, for all of which demand at present is much in excess of domestic supply...

'Iron and steel are of basic importance to development whether in agriculture, industry, or in transport, and since they are also essential for defence, they have to be given the highest priority. This is now an accepted part of the Government policy and a scheme has been worked out for the establishment of an integrated pig-iron cum steel plant in the near future.'

The Commission fixed the following targets for the private sector :

	Unit	1950-1		1955-6	
		Rated capacity	Production	Rated capacity	Production
Pig-iron	'000 tons	1,850	1,572	2,700	1,950
Steel (main producers)	'000 tons	975	976	1,550	1,280

State Steel Works

On the principle that the State must play a progressively active role in the development of industries but not take more responsibility than permitted by its resources, the Government of India has decided to establish steel works of its own capable of producing 1 million tons of steel per year.

The capacity of the existing steel works is about 1 million tons, while the estimated demand is well over 2½ million per year. Even after taking into consideration the expansion plans of Tatas, SCOB

and Mysore Iron and Steel Works, production will, it is estimated, fall short of demand by at least a million tons per year.

As long ago as 1947 the Iron and Steel Panel, in view of the acute shortage of pig-iron and steel in the country, recommended an increase of production by one million tons. In February 1952, the Government decided that, along with other measures for the expansion of the iron and steel industry, negotiations should be opened with steel firms abroad for putting up a blast furnace, with a capacity of about one million tons a year, with necessary services, at a new site to be selected in consultation with the prospective participants; also that Government should participate in the undertaking by providing the necessary finance. Several steel firms of international repute were sounded. In October 1952, an official delegation went to the U.S.A. for negotiations with a Japanese-American group of steel makers and the World Bank. On return, it advised the Government that the best way to begin was to have a project report prepared by people qualified to advise. An up-to-date project report was obtained from leading foreign concerns.

On 15 August 1953, an agreement laying down the basic conditions of co-operation for the establishment of an iron and steel plant in India was entered into with the well known German firms, Messrs. Fried Krupp and Demag A. G. As stipulated in the agreement, a body of technical experts from their group visited India in the last quarter of 1953 to assess the merits of different sites for the location of the factory and to recommend to the Government of India the one most suitable for the purpose. On 21 December 1953, two agreements, supplementing that of August, were entered into with the German combine; the first related mainly to the financial provisions for the formation of a company and the basis of Indo-German partnership; and the second provided for technical consultation arrangements for the planning, erection, and initial operation of the new steel plant. The Memorandum and Articles of Association for a private limited company under the name Hindustan Steel Limited, with an authorized capital of Rs 100 crores, were also signed the same day. The Government of India received the recommendations of the German combine on the question of location on 25 January 1954. After consultation with the State Governments concerned, it was decided on 15 February 1954 that the plant should be located at Rourkela in Orissa.

The plant will have an initial ingot capacity of 5,00,000 tons per annum with provision for doubling the capacity later. It is expected that, simultaneously with the commencement of production, it will be possible to instal the additional capacity so that the production will rise to one million tons per annum three or four years thereafter.

Provided ancillary facilities such as railways, water and electricity are available, the German collaborators expected that the plant could be commissioned within a period of four years.

The capital cost of the project is estimated at Rs 71.25 crores. The share capital to be contributed by the two firms is expected to be of the order of Rs 9.5 crores, the exact amount depending upon the value of plant that they may supply. Purchase of such plant and equipment will, however, be on a competitive basis, supply being arranged by global tenders. The balance of share capital will be found by the Government of India.

The German investment will be for a period of 10 years with option to either side to continue the association for a further period. The German combine will act as technical consultants for the designing and erection of the works and will also be in general charge of the construction. For this they will receive a fixed fee of about Rs 2.1 crores in addition to actual expenses in India, subject to a ceiling of Rs 70 lakhs. No royalties are payable. Hindustan Steel Limited is being incorporated with an initial capital issue of Rs 5 lakhs of which Rs 4 lakhs are to be contributed by the Government of India, and Rs 1 lakh jointly by Messrs. Fried Krupp and Demag A. G. Subsequent issues of share capital will be made with reference to the progress of expenditure, preserving the ratio of 4:1 in the shareholding between the Government and the Combine. It is intended that a substantial proportion of the capital investment will be in the form of loans, raised externally and internally. The management of the company will be vested in a board, in which the Government and the Combine will have representation proportionate to their respective investments. The Chairman and the Managing Director will be nominees of the Government.

A second State steel plant is under consideration. Its inclusion in the scheme for an Industries Development Corporation, conceived by the Minister for Commerce and Industry and accepted by the Government in principle, is evidence of the importance attached to the project. A further intensive survey, examination and analysis of the mineral resources of Madhya Pradesh is to be taken in hand immediately, with particular reference to the occurrence of iron ore and coal. Inquiries are also being instituted as to the iron ore deposits in the Krishna district of Andhra.

The agreement with the German combine marks the beginning of what is to be the biggest industrial project in the public sector.

Among welcome features of the agreement are: the control will be in Indian hands; Indians will be trained in the operation of the plant in India and in Germany; the reported assurance by the

German combine that when in full operation 'the unit cost of production would compare favourably with that in any other plant'; the plant will produce largely plates and other 'flat products' for which there is a growing demand in the country. The company's accounts will be scrutinized by the Auditor-General and the conditions governing re-purchase are wide enough to ensure protection of national interests.

Not all comment, however, has been congratulatory. For instance, it is asked how, in view of the Comptroller and Auditor-General's criticism of that type of State enterprise, the private company form of management has been chosen. The entry of the Government into the capital market for sums on the scale that appears to be contemplated, thus competing with private business for the small amount of saving in the country, might result, it is feared, in insufficient funds being left for financing the needs of the private sector. It has been suggested that 'the Government should not concern itself with more development than could be properly undertaken; as it is, some projects seemingly did not have the careful preliminary consideration requisited' (*The Statesman*). It has been asked whether the agreement arrived at could be deemed better than the alternatives of encouraging the existing units to expand production or entering into a contract with parties other than Krupps and Demag. Whether with Krupps and Demag themselves, better terms could not have been reached has also been questioned. Notwithstanding the view of the Planning Commission that 'in the present circumstances, the best method of financing and operating a new steel plant would be through collaboration between the State and any Indian concern with knowledge and experience in the industry and ability to raise equity capital,' the Government, it is pointed out, did not even consider it necessary to associate with the negotiations non-officials with knowledge of the technique of the steel industry. The foreign exchange regulations in Germany and the fact that that country itself has had to apply to the World Bank for a loan on behalf of another iron and steel manufacturer are, it is argued, not likely to make it easy for the Company to contribute towards the share capital. Indeed, it is feared that in the circumstances the contribution by the German firm might be only in the form of machinery. And somewhat uncharitably it has been suggested that in their capacity as technical consultants they are likely to influence decision on the global tenders. India, it is added, may find herself forced to accept the German tenders, however uncompetitive.

The advisability of investing about Rs 71 crores on a plant of only 5 lakh tons capacity has also been questioned. The existing units, it is argued, could at much less cost effect that increase in production.

The claim that the cost of steel produced would be competitive is discounted. The Tariff Commission, it is pointed out, in calculating the retention prices in the case of Tatas, had taken into account the value of the block at about Rs 44 crores and working capital at Rs 9 crores. In the case of the new plant, with roughly half the productive capacity of Tatas, provision will have to be made, it is argued, for a return on an investment of Rs 71 crores. The possibility of private companies' having to subsidize the output of the new plant through a system of pool prices is apprehended by some.

Assistance to Private Enterprise

Besides pursuing the project for the establishment of State-owned steel plants to produce another 1 million tons annually, the Government of India has been rendering all possible assistance to the main producers to expand production.

The Indian Iron and Steel Co. have been granted loans totalling 7.9 crores, as well as a repayable advance of Rs 10 crores. Further, a World Bank loan of about Rs 15 crores has been arranged under Government guarantee. It was reported that this company had projects under execution which would by the end of 1957 increase its installed capacity for finished steel to 7,00,000 tons per annum and 4,00,000 tons of foundry iron. It is understood that the scheme for the expansion of the plant at the Steel Corporation of Bengal works includes the augmenting of steel melting capacity and provision of certain other auxiliary facilities. New rolling mills for the finishing of structural and 'merchant' material are also to be added. This expansion scheme is well under way. It is learnt that orders have already been placed for a sheet bar and a billet mill at a cost of Rs 2 crores.

In June 1952, a World Bank Mission led by Mr. George D. Woods visited the steel works at Jamshedpur and Burnpur where it assembled estimates of future iron and steel requirements and examined the financial status of the steel-producing companies.

It reported that the demand for iron and steel in India was substantially in excess of productive capacity and that the country had exceptionally high-grade iron ore and the necessary grades of coal, and indicated willingness to recommend financial assistance to existing producers for the purposes of expansion.

Tatas have on hand a scheme for expansion and modernization of their works with a view to increasing the output from 7,50,000 tons to about 9,31,000 tons a year — an increase of about 1,80,000 tons of steel by the end of 1957. The company's great need, as of some other producers, is replacement of machinery overworked during the war.

Among the more important items of the scheme are the establishment of a new steel melting shop capable of producing 5,40,000 tons of ingots per year, a skelp mill to produce skelps and strips, a tube mill to be worked jointly with a foreign company to manufacture welded tubes and a plant for the manufacture of refractories.

This expansion is estimated to cost about Rs 22.71 crores. In addition, the company proposes to spend during this period Rs 10.21 crores on normal expenditure in respect of works, township, ore mines, collieries and by-product plants. Of the total estimated cost of Rs 33 crores, the company hopes to meet Rs 21 crores from its depreciation and reserve funds and Government has made available to the company an advance of Rs 10 crores.

Another means of raising money was the conversion in Tatas of the 'Deferred' shares into 'Ordinary'. The liquidation of 'Deferred' shares became necessary because the company could not increase its capital without legally treading on the toes of the 'Deferred' shareholders, and the Government of India declined to give the company a loan unless it rearranged its capital structure.

There is yet another unit engaged in expanding and modernizing plant—the Mysore Iron and Steel Works. The first stage of the proposed expansion includes two 100-110-ton electric pig-iron furnaces. In order to utilize the increased pig-iron tonnage, a Bessemer Converter Electric Furnace Duplex Plant is to be installed. The establishment of a new billet mill and light structural mills is also contemplated. The expansion programme is expected to step up their production from 40,000 tons to 1,00,000 tons. It is likely to be completed by 1955, provided the Government makes available the necessary finance. The total estimated cost of the scheme is Rs 5½ crores, of which Rs 2.82 crores may be lent by the Government.

Mr. Mahatab, a former Minister for Industry and Commerce, in an address to industrialists called for production up to full installation capacity. Obviously much greater efforts are needed to step up production if we are not to be caught in the receding tide.

Raw Materials

But there are several difficulties in the way of increasing production itself, apart from the achievement of any definite objective. Indeed, they prolong and accentuate the shortage of iron and steel products in India. First, there are dwindling resources of good coking coal. Tatas have complained not only of short supplies but of the quality of coal; and have attributed, tacitly if not explicitly, fall in production to such handicaps. There is ample evidence, however, of effort to improve

the situation. Possibly the only need now is to increase the tempo of action. Coupled with the shortage of good coking coal, there is, it appears, in aggravation, also a shortage of other raw materials such as limestone, ferro-alloys and imported stores.

'Large' is the term often used to describe India's natural resources. Unfortunately it is largely wrong. At best, it is only relatively right.

India's natural resources do not seem to deserve any extravagant adjectives in the context of her area and population.

Ore and coal account for nearly 80 per cent of the cost of pig-iron and 60 per cent of the cost of finished steel. Their ready availability explains the low cost of steel produced in India.

Extensive deposits of iron ore occur in several parts of India, viz., Bihar, Orissa, Madhya Pradesh, Mysore and Madras. Of these the deposits in the Singhbhum district of Bihar, and in the adjacent areas of Bonai, Keonjhar and Mayurbhanj, which have now merged with Orissa, are the most important, being the largest in extent as well as richest in iron content. Reserves are estimated as follows :

	Million tons	Iron content per cent
Singhbhum and Orissa	8,000	60-68
Drug district, Madhya Pradesh	175	60-68
Bastar State, Madhya Pradesh	610	60-68
Chanda district, Madhya Pradesh	30	60-68
Mysore	150	55-65
Madras (Salem and Trichinopoly districts)	305	35-40
	<hr/> 9,270	

Coal has been for years largely the foundation of all industry in India and is likely, as things are, to retain that status for some considerable time. Of its importance to the iron and steel industry, in particular, no more need be said than that two and a half tons of coal are required to make one ton of steel. India's reserves of coking coal—the type of coal essential for the manufacture of iron and steel—are limited ; and concern has often been expressed at the reckless rapidity with which they are being spent.

The chief coalfields are in the Damodar Valley in Bengal and Bihar : coalfields of varying size also occur in Madhya Pradesh, Orissa and Hyderabad, as well as in Bikaner, Assam, Kashmir and Madras. The good quality coking coals are confined to the Jharia, Raniganj, Giridih and Bokaro coalfields in Bengal and Bihar.

The deposits of fire-clay are widespread throughout India, viz., Bengal, Bihar, Madhya Pradesh, Madhya Bharat, Orissa, Mysore, Rajasthan, Saurashtra and Vindhya Pradesh. There is usually,

44-66 per cent of silica in the composition of Indian fire-clay. The discovery of large deposits in the Korba coalfield area of Madhya Pradesh has added to reserves of fire-clay.

Silica sand and stone occur in the Sirohi and Sabarkantha districts in Bombay, Saurashtra, Seraikela and Singhbhum in Bihar, Bundi and Karauli in Rajasthan and Mayurbhanj in Orissa.

Supplies of limestone, required as a flux both in blast furnaces and in basic steel-making, are obtained from Gangpur State and also from Madhya Pradesh. Fluorspar is imported. Fortunately for India, considerable quantities of her iron ore deposits are near her coal regions. The saving in freight which this circumstance has effected is far greater than is generally recognized, for freight figures largely in the cost of production.

By a further piece of good fortune, the iron content in Indian ore is about 68.7 per cent. Few of even the great iron and steel producing countries of the world can claim a higher percentage. Yet the situation does not warrant complacency.

By what appears to be a law of compensation the country's coal is not the best for the manufacture of iron and steel. It is, commercially speaking, 'not up to specification'. Much of what is now available has, it appears, a high ash content and low calorific value; reserves of good coking coal in India are limited. The policy of coal conservation that is being pursued may yet save the situation.

On the other hand, there is abundant manpower, unemployed and under-employed. The value of these vast human reserves has yet to be correctly assessed; possibly it is far greater than the value of the raw material, and if properly used may play a most important part in the task of national renovation.

Electric smelting of large quantities of iron ore is being attempted for the first time in this country. The availability of oxygen in commercial quantities has made possible its extensive use in metallurgical operations.

Production

The index of industrial production in respect of steel, compiled by the Department of Commercial Intelligence and Statistics, shows, taking 1937 as the base year : 100, that during the war there was a rapid and significant rise in production, reaching 142.9 in 1945, and that with the end of the war there was a downward trend touching 97.1 in 1947 and 1948. However, in 1949 the figure rose to 104.6.

According to the Interim Index of Industrial Production compiled by the Directorate of Industrial Statistics, taking 1946 as the base year : 100, production of steel (ingots and metal for castings) in 1947 and

1948 registered 97.1; in 1949, 104.6; in 1950, 111.2; in 1951, 116.0 and in 1952, 122.0.

The table below shows the extent and variety of production in iron and steel during the last few years :

Year	Pig-iron	Direct castings	(Figures in '000 tons)				Steel tubes (tons)
			Ferro-alloys	Steel ingots and metals for castings	Semi-finished steel	Finished steel	
1946	1,346.4	75.6	15.6	1,293.6	1,030.8	890.4	..
1947	1,320.0	97.2	18.0	1,256.4	1,027.2	892.8	..
1948	1,405.2	51.6	7.2	1,256.4	1,011.6	856.8	—
1949	1,527.6	63.6	19.2	1,352.4	1,105.2	930.0	470.4
1950	1,562.4	98.4	18.0	1,437.6	1,142.4	1,004.4	427.2
1951	1,708.8	92.4	24.0	1,500.0	1,249.2	1,076.4	456.0
1952	1,684.8	129.6	40.8	1,578.0	1,308.0	1,102.8	214.8
1953	1,654.8	115.2	7.2	1,507.2	1,230.0	1,017.6	—

It was hoped that, with the expansion of the steel companies, the upward curve would be maintained, but in 1953 production went down owing, largely, to labour troubles.

The figures above furnish only a fragment of the picture. The industry has to be viewed in the larger perspective of world production.

World production of steel in 1953 was estimated at approximately 254 million tons, showing an increase of 11 per cent over 1952.

In spite of her area, natural advantages and population, India occupies a place subordinate to that of such small countries as Belgium, Luxembourg, and Czechoslovakia.

Two grades of pig-iron—one for use in the manufacture of steel and the other by engineering industries—are produced by Tatas and SCOB, the average monthly production being about 1,30,000 tons. Of this, nearly 25,000 tons are foundry grade pig-iron, consumed by engineering industries against their total monthly requirements of 50,000 tons. Although the production of the other grade is sufficient to meet present needs, an increase in its production is also necessary in view of the plan to expand the steel industry. In November 1951, the Council of Scientific and Industrial Research recommended to the Government of India the setting up of additional blast furnaces in India to increase the production of pig-iron. The Council discussed the acute shortage of pig-iron in the country and the probability of the small quantity available to foundries being further reduced when the production of steel was increased.

As a result of the expansion now in progress, appreciable increases in production are expected by the end of the Five-Year Plan period. Production of pig-iron is expected to rise by 3,10,000 tons and that of steel by 3,94,000 tons.

Condition of Plant

Even were raw materials of the requisite quality available in adequate quantities, the condition of the plant in the industry, it is feared, might not permit of the substantial increase in production contemplated. Sir Padamji P. Ginwala summed up the situation in respect of existing equipment admirably (*Capital*, 15 June 1950). He wrote :

'The Iron and Steel (Major) Panel, of which I had the privilege of being the Chairman, emphasized more than four years ago that apart from the wear and tear caused by the war on all the units functioning at the time, many, if not most of them, had been constructed 20 to 25 years previously or even earlier, and that, having been in continuous operation, some of them had more than completed their usual life. They accordingly recommended that absolute precedence was to be given to their replacement by up-to-date equipment and its maintenance in a state of efficiency at all times.

'Little heed has been paid to this recommendation either by the industry or by the Government. With the passage of four more years the position has worsened. Breakdowns, some of them serious, have been in evidence now and again. They must be expected to be more frequent as time passes. The Breakdown of a single key unit may bring the operation of a whole plant to a standstill with disastrous effects not only on the producer but on many other industries, including those connected with defence.'

The conclusion that the above is largely a confession of the condition of machinery in SCOB does not seem altogether unjustifiable. In so far as Tatas are concerned, their annual reports offer ample confirmation of the correctness of Sir Padamji's analysis. For instance, their Annual Report for 1948-9 contained the following significant section : 'Based on the report of our consulting engineers, an extensive scheme of major repairs and replacements has been worked out and is now engaging the attention of your Directors. It includes, among its major items, construction of a new open hearth plant to replace the present plant which has been in existence since the inception of the company, a new battery of coke ovens, extension of the power plant, extensive repairs and replacements to the blooming mill and soaking pits as well as renovation and extension of the jute mill. This is a programme of considerable magnitude which will extend over a period of years. The question of financing it is engaging the careful attention of your Directors.'

Increase in production of the quantum contemplated cannot, therefore, obviously be effected with the existing plant. Either extensive repairs or replacement is called for ; the latter, it appears, would prove

in the long run to be the more economical. The plant and equipment necessary are mostly of foreign manufacture. The industry has to depend upon imports for its continuance. And the international situation is likely to lessen to a marked degree India's chances of getting capital equipment from abroad.

Cost of Replacement

The cost of replacement is another factor that has to be reckoned with. Finance has to be found for purchases (if available) from abroad. Machinery prices are now nearly four times pre-war. And, as heavy machinery is required for the iron and steel industry, the cost of replacement is likely to be in the neighbourhood of Rs 15 crores. Latterly, private capital has been chary of investing large sums of money in industry. Reasons are not far to seek, at any rate so far as the iron and steel industry is concerned.

Taking 1939 as the base year : 100, profits in the industry stood at 120.2 in 1945 ; they fell to 101.3 in 1946, and to 86.1 in 1947. Although the figure for 1952 showed a rise to 162.6, the reaction in the investment market was not satisfactory. Private enterprise is, as always, averse to taking decisions against a background of doubt as to its ultimate fate.

The threat of nationalization hangs precariously suspended over the industry. A lease of ten years is hardly likely to encourage investment. There will not be time enough, the capitalist fears, to reap the rewards of investment. And of the many adjectives used by capitalists to describe the present system of taxation of industry, 'predatory' is about the most charitable.

The assurance that 'the system of taxation will be reviewed and readjusted to encourage saving and productive investment and to prevent undue concentration of wealth in a small section of the population' is hardly likely to be received with acclamation by those who alone can provide the wherewithal for the development of industry. To dismiss them as reactionaries would take us no nearer the solution of our problems. Henry Sidgwick, the Cambridge philosopher and economist, is reported to have once said that the best way to happiness was 'to take an active interest in tolerably prosperous persons and institutions'.

Of singular importance to the iron and steel industry is the depreciation allowed by the Government on machinery. It is based on original cost—a procedure which financial interests denounce as grossly unjust. The condition that it should be based on the replacement cost, which is very much higher, has not been accepted by the Government. And to imagine that control over prices promotes investment is to misread

history and economics. Even in the days of the most liberal control, private enterprise was persistent in its demands for what it called 'reasonable profit margins'.

Labour

And above all, the rising labour cost and the falling *per capita* production in industry have not merely put off many a prospective investor ; they have in a sense stifled the incentive for increased production. Skilled and unskilled labour employed in the industry is about 76,600 ; a number which, in the opinion of producers, Government and outside experts, is much in excess of requirements. Among the numerous great changes which the war wrought in India's economy few, apart from the gradual change in the occupational pattern of the country, may be more significant than the elevation of a considerable part of Indian industrial labour to higher levels of income.

Obviously, increased charges of these dimensions could not be borne by the industries without a compensatory revision of their price schedules ; and the consumer has paid. Moreover, production *per capita* has been in inverse ratio to the increase in earnings.

Absenteeism (i.e. percentage of manshifts lost to manshifts scheduled to work) in the iron and steel industry was about 14.3 in 1948 ; in 1949, about 13.5 ; in 1950, about 12.4 ; in 1951, about 11.0 ; and in 1952, about 10.9. The situation is hardly satisfactory and is aggravated by the presence of two or three competing trade unions with apparently no great differences in their ideologies. Industrialists are alarmed at the portents ; and they contend that they cannot continue such high emoluments to labour ; that competitive conditions would be impaired and their ability to operate jeopardized. The tendency of both parties to rate the standards of personal prosperity too highly is among the first few obstacles that need to be surmounted.

It is clear that there can be no increase in production, such as we want, without an equitable solution of the question of labour relations. And a ~~solution~~ seems possible only by an effective implementation of the view held by the Government that 'labour's share of the profits should be on a sliding scale normally varying with production'.

Experience in other countries confirms the correctness of this approach. A Review of the Iron and Steel Trade in the U.K. contains the significant sentence : 'In the iron and steel plants the practice of payments by results has been abundantly vindicated and linked with this is a system of promotion which is an ever present source of encouragement to the zealous and ambitious worker.'

With effort and goodwill on both sides, it should not be impossible to ensure, even within the context of a mixed economy, a fair measure of social justice. An amendment to the Industrial Disputes Act was introduced to regulate industrial relations, and it was hoped that it would provide the basis for harmonious employer-labour relations. But, even at best, legislation is only a palliative and has rarely proved itself to be better. The cure will depend in the long run 'in training and education and in the far-seeing management of business undertakings'.

Metallurgical Research and Training

Apart from assisting the iron and steel industry to increase production and establishing its own steel works, the Government of India has encouraged research in metallurgy. A Board of Industrial and Scientific Research was set up in 1940 to co-ordinate and conduct research on a planned and scientific basis; and in 1942 a Council of Scientific and Industrial Research was brought into being.

The most important of the Council's undertakings was the planning of seven national laboratories; of these, the National Metallurgical Laboratory at Jamshedpur and the National Fuel Research Institute, Jealgora, are of importance to the future of the iron and steel industry.

The Council is promoting the formation of Industrial Research Associations on a co-operative basis with a view to integrating the activities of the Government with those of the industry in the field of industrial research. Funds for these associations are to be provided jointly by the industry concerned and the Government. It is hoped by this method to eliminate the time lag between scientific discovery in the laboratory and actual production in the factory.

Although schemes of technical training implemented by Government and the industry have made considerable progress (the number of Indian technical personnel engaged in industry is rapidly increasing), there is need, as the Fiscal Commission has observed, for certain types of expert service connected with plant capacity and production control, stores and organization control, raw material control, quality control and costing. One important lacuna in our scheme of technical training is the lack of facilities for training technicians of the foreman class. To remedy this drawback, technical institutes, on the model of the one recently started by the Indian Jute Mills Association, should be extended to other industries also.

Mention must be made, however, of the establishment of a temporary Foundrymen's Training Centre at the Indian Institute of Technology, Kharagpur, to run short industrial courses in modern foundry prac-

tice. This follows a recommendation by Mr. John F. Schnur, Foundry Technologist, Armour Research Foundation, Chicago, whose services were lent to India under the Point Four Programme to introduce the latest foundry practices in India. The establishment of the Centre should make his experience available on a large scale to foundries.

Tests and Standards

The Government of India has established at its Test House at Alipore, Calcutta, a 2,50,000 volt industrial X-ray plant, which is capable of examining steels up to three inches in thickness and lighter metals and alloys up to any thickness normally used in industry.

The Indian Standards Institution is yet another organization established by the Government for the promotion of industry. Its task, as its name implies, is to prescribe standards for industrial products; and it is hoped that its activities will lead to an increase in efficiency. The Fiscal Commission is of the opinion that 'there is a *prima facie* case for making the observance of the approved standards obligatory on the industries concerned—at any rate on those industries which have a large export market or which provide the raw materials of exportable commodities'.

Ordnance Factories

There are three Government ordnance factories, one at Ishapore, one at Kanpur and the third at Muradnagar near Meerut. Primarily their production is to meet Service requirements. The Ishapore plant has two small open-hearth furnaces, producing some 24,000 tons of ingots per annum and two 2-ton electric arc furnaces for special steels. It operates a blooming mill and a rod mill in addition to forging presses.

In view of the inadequacy of the forging industry it has been suggested that the ordnance factories at Ishapore and Kanpur may be used as nuclei for a medium-heavy industry in India. The ordnance factories are able to produce special steels for munitions purposes.

The Government is establishing a machine tools factory at Bangalore. The estimated cost of the factory is said to be Rs 8.37 crores. It is hoped that it will be able to manufacture tools worth about Rs 4 crores and help in repairing and reconditioning machine tools which arrived in India by way of reparations from Germany.

Ancillary Industries

The iron and steel industry in India may be divided broadly into two categories—basic and re-rolling. The main producers, who melt iron

ore and make pig-iron, out of which they manufacture steel in open hearth and other furnaces, may be placed in the first category.

Alongside these there is a wide range of subsidiaries not directly engaged in basic processes. There are the re-rollers who produce certain sections of steel machines from billets and scrap supplied by the main steel producers ; but some of them have electric furnaces with which they make steel. It is estimated that there are about 95 steel re-rolling mills in India, producing sections of steel from billets supplied by the main producers and from scrap.

The capacity of the mills is about 5,00,000 tons, and the annual production is said to be about 90,000 tons. Some of the re-rolling companies, particularly the bigger ones, draw their supplies under agreement with the main producers, or are operated by them.

The relations between the main producers and the secondary producers were none too happy some time ago. In fact, early in 1947, the re-rollers represented to the Tariff Board that they were not receiving sufficient material at economic prices to keep their units running ; that there was a great insufficiency of pig-iron ; and that the manufacturers of cast iron pipes and fittings were not getting a fair deal from the main producers.

With the allotment by the Iron and Steel Controller of all imported billets and a portion of those produced by the main producers to the re-rolling industry—a blood transfusion from the better nourished to the debilitated—the situation improved. But the problem of providing the re-rollers with sufficient quantities of billets from indigenous sources persists and will need to be settled if there is to be a harmonious development of the iron and steel industry as a whole.

Tinplate Production

Tinplate for the metal box and container trade is being produced by the Tinplate Company of India Ltd. The company draws its supplies from the Tata Iron & Steel Company and its production meets almost all of India's present demand.

Companies capable of producing a wide range of light and annealed, hard bright, galvanized and barbed wire, wire nails, bolts, nuts and rivets (e.g., the Indian Steel Wire Products Ltd.) and others who can manufacture railway permanent way equipment, including steel sleepers, points and crossing rails, signal materials, special bolts and nuts, and other essential components for the maintenance of the Indian railways, have also come into existence.

In addition, there is a steel processing industry for the construction of wagons and other railway rolling stock. The most important member

is the Indian Standard Wagon Co. Ltd. Latterly this industry has had a severe set-back. Orders from Government, on which the industry depends almost entirely for its maintenance, have fallen off—due possibly to the measures of economy enforced by the railways—and in fact many companies have had to surrender their quota of iron and steel.

Refractories

Almost simultaneously with the growth of the iron and steel industry there have grown up refractories which provide the brick and hearth material for the industry. A statement is subjoined to show the rate and trend of production of refractories in this country :

Year	Production (in thousand tons)	
1946	...	156.0
1947	...	175.2
1948	...	189.6
1949	...	208.6
1950	...	236.4
1951	...	237.6
1952	...	243.6
1953	...	228.0

Although the trend is towards an increase in production, it is feared that the existing works would not be able to supply also the brick and hearth material (about 7,500 tons) which the two steel plants to be constructed by the Government would need. The Ceramics Panel appointed by the Government of India recommended that the present production of refractories should be doubled within 10 to 15 years, and the Government of India, in close consultation with the main producers, is exploring the possibility of constructing new refractory works to meet the anticipated demand.

Imports and Exports

The following figures published by the Government of India in its Monthly Abstract of Statistics summarize the position in respect of imports :

Year	Imports of Foreign Merchandise	Months
	Monthly Averages or Calendar (In thousand rupees)	Articles wholly or mainly manufactured
	Machinery of all kinds including belting for machinery	Iron and Steel manufactures
1950	7,98,33	1,49,92
1951	8,29,14	1,68,42
1952	7,91,21	2,13,15
1953	7,24,50	1,91,49

India was unable to produce many of these articles, at any rate in sufficient quantities to meet the internal demand. The situation has not changed appreciably since 1948. The Iron and Steel (Major) Panel estimated in 1946 that it would be another seven years before India achieved self-sufficiency in iron and steel. True that schemes for the expansion of the existing iron and steel industry are being actively pursued; true also that the Government is contemplating establishing two new plants to increase production. Yet, viewed in the light of the rapidly increasing requirements of other organized industries, railways and public utility undertakings, it would appear that for some considerable time the gap between production and demand will have to be met by imports.

Since the end of the war there has been a steady increase in the flow of machinery into the country with the result that this item has now come almost to head the list of imported goods. This is all to the good. It needs to be so for some time if Indian industrial development is to be significant.

Imports of machinery during the last few years have helped considerably either in the rehabilitation of old industries or in paving the way for the establishment of new industries. Indeed, in countries like India where manufacture of capital goods is still embryonic, imports of machinery may be taken as a reliable index of the pace of industrialization. One has to confess to a fear, however, that although India still lacks even the minimum equipment for many of her key industries the balance of machinery imports is still largely in favour of consumer goods industries.

Happily, in the import policy of the Government of India high priority has been given to the importation of capital goods; and in fixing monetary ceilings for imports consideration has been given to the need for the maintenance and development of industrial production. The validity of licences for heavy electrical plant and other machinery

goods is for a period of three years. Normally licences are granted only for six-monthly periods.

The limiting factor, however, is the ability of foreign countries to supply adequately and economically India's needs in iron and steel and machinery. In spite of the strenuous efforts being made in other countries to increase production of steel—and some of them have met with remarkable success—it is extremely doubtful if any large surpluses, after meeting their own needs of industrial rehabilitation, will be available for export to India; and even if they were available, the prices, it is feared, would in many cases be considerably higher than those of the corresponding qualities of Indian products.

Difficulties, it appears, are being experienced also in the importation from South Africa of fluorspar, which is used in basic furnaces. It is not known whether alternative sources of supply are being explored. And it has been suggested that Indian pig-iron is not suitable for making guns and armour and that special phosphorus for hematite iron is being imported from the U.K. Are any attempts being made to eliminate this dangerous dependence upon another country for an article essential for the manufacture of armaments?

Imports of capital goods account for nearly 17 to 25 per cent of India's imports during the three immediate post-war years. The bulk of imports comprised pillars, girders, bridge work, bolts and nuts, fencing material, nails, pipes, railway track material and fittings. To meet the requirements of the secondary producers, fairly large quantities of blooms, billets and slabs were also imported.

Total imports of steel in 1951 amounted only to about 1,50,000 tons as against 2,84,125 tons in 1950 and 3,97,964 tons in 1949.

The quantity imported by Government and the average price paid per ton during 1950 and 1951 were as follows :

Year	Quantity (in tons)	Average price (in rupees per ton)
1950	63,688	500
1951	12,691	900

Imports in tons amounted to 45,021 in 1952-3. They included supplies of steel under the Technical Co-operation Scheme of the U.S. Government. In January 1954 another operational agreement was entered into between the Governments of the U.S.A. and India under which 2,00,000 tons of steel would be available to this country for use in economic development. It involves about \$25.5 million. The rupee cost, which will be borne by the Government of India, amounts to Rs 1.5 crore. The purpose is to alleviate the deficiency of steel. It

was estimated that during the period July '53 to June '54 the demands for the types of steel to be imported (i.e. sheets, plates, rails, sleeper bars) would be approximately 7,25,000 tons while the production of such steel in India during this period was not likely to be more than 3,40,000 tons. The steel acquired under this agreement was to be used in development schemes in agriculture, industry, railways and major river valley projects.

On the export side, pig-iron and manganese ore have been the principal commodities. A study of the statement below, taken from the Monthly Abstract of Statistics published by the Government of India, will give some indication of Indian activity in the iron and steel world market :

Exports of Merchandise

Year	Monthly averages (in thousand tons)	Pig-iron
	Manganese Ore	
1938	43	44
1945	14	6
1946	36	1
1947	38	—
1948	27	4 (April to Dec.)
1949	45	5
1950	65	3
1951	85	4
1952	117	1
1953	126	1

In the inter-war period, particularly from 1923, India became an important supplier of pig-iron in the world market and was exporting the commodity to several parts of the world. The Commonwealth initially imported little from India. In fact, Japan was the largest purchaser between 1927 and 1939. Thereafter the U.K. took the bulk of the exportable surplus. Pig-iron is still being exported, but it is of a type unsuitable for Indian foundries, and the quantities are negligible.

In March 1952 a Japanese Industrial Mission visited India. The Mission expressed Japan's desire to import very much larger quantities of iron ore from India than India had been supplying to Japan in recent years.

Exports of iron and steel are permitted only in small quantities and they are confined to cases where bilateral trade agreements impose the obligation—a sound policy for a country which has to import raw materials.

Though belated, there has been an attempt to promote the manufacture and export of steel products. Towards the end of 1952 the Government of India decided to make available to manufacturers of such articles, subject to certain conditions, additional quantities of iron and steel. The import duty on some varieties of steel and steel sheets (both black and galvanized), plates and rails was abolished, at a loss to the exchequer of about Rs 25 lakhs. A rebate of import duty was given on some steel raw materials imported for use (e.g. steel strips used in the manufacture of razor blades, pipes and tubes, including conduit pipes). The import quota for iron and steel bolts, nuts, set screws, machine screws, and machine studs, but excluding bolts, nuts and screws adapted for use on cycles, was increased from 12½ per cent to 25 per cent. The quota for iron and steel rivets was doubled. In 1953 it was announced that the export of fabrication steel structurals would be licensed freely. Fresh quota of steel would be allowed, it was added, only in cases where the export price was not less than Rs 1,000 per ton. October 1953 brought the announcement of the abolition of export duty on iron and steel bars, heavy structurals, tin plates and baling hoops. Obviously the intention was to improve the competitive position of these articles in foreign markets. These indirect exports of steel (e.g. sewing machines) have been some of the most successful classes of goods in the Indian export drive.

Tariff Protection

During the period of depression after World War I, the iron and steel industry in India had to face foreign competition since imported steel was being dumped in the Indian market at rates cheaper than the rising cost of Indian steel. In 1923 the Tata Iron & Steel Company applied to the Government for protection of the steel industry. As a result of the tariff inquiry into the company's case, protection was given to the iron and steel industry in India in 1924 by imposing protective duties on imported iron and steel materials of those categories which were being produced in India.

Since 1924 there have been three main tariff inquiries into the case of the iron and steel industry : in 1924, 1926 and 1934. In between, there, have been three supplementary inquiries and five special inquiries for subsidiary industries. The scheme of protection sanctioned as a result of the tariff inquiry held in 1934 was to remain in force for seven years,

until 31 March 1941. Before this protection expired, however, World War II intervened, and the protective duties on imported steel were continued from time to time by continuation Acts, the last extension being for a period of one year till 31 March 1947.

The scheme of protection to the iron and steel industry in India was discontinued from 1 April 1947, as it had become superfluous ; but the quantum of protective duties continue as revenue duties.

As early as 1947, at a conference convened by the Indian Tariff Board, several speakers urged upon the Board the need for holding a full-fledged inquiry into the organization, efficiency and equipment of the steel industry. In their opinion such an inquiry was necessary 'to safeguard the consumers' interest'. It was pointed out by them that, although steel was produced more cheaply in India than in many other countries, the full benefit of cheap production was not passed on to the consumer.

Space forbids a detailed examination of the principles on which the policy of tariff protection has been based. Although unexceptionable in theory, the manner in which protection has been given from time to time with reference to such principles has been the subject of considerable criticism. Indeed an economist called it 'the most egregious piece of question begging'. The attack has been particularly fierce on the inevitable concomitant of tariff protection, i.e., the cost to the community. It has been alleged that this aspect of tariff policy should have received far greater attention from the Government than it has.

Computation of the cost of tariff protection to the community is always and in any country a difficult task, for there are certain elements in its composition which it is almost impossible to assess accurately. The task is made all the more difficult in India by prevailing economic perplexities. Yet, taken in the round, it would appear that the advantages which have accrued to the community from the protection granted to the iron and steel industry have offset the burden on the consumer ; and that the bulk of any burden that it might have imposed has been borne by the more well-to-do sections of society.

But the other criticism, that the protective tariff on iron and steel products, as much as on other products, made both Government and industrialists oblivious to the fundamental factors which determine the growth of virile and healthy industries, is more difficult to meet.

Fortunately, however, the iron and steel industry no longer needs protection except against 'dumping' by foreign countries—a possibility that cannot be rejected out of hand. What is still more fortunate is that there has been, as the Fiscal Commission has observed 'a funda-

mental shift in thought in recent years on the subject of protection in relation to the country's industrial development and emphasis has now been transferred from the negative idea of safeguards against foreign competition to the positive conception of the fullest utilization of our resources'.

In its statement on industrial policy the Government of India has declared that 'the tariff policy of the Government will be designed to prevent unfair competition and to promote the utilization of India's resources without imposing unjustifiable burdens on the consumer'.

Selling and Retention Prices

During World War II, imports of iron and steel into India declined and the prices of imported materials rose. Gradually foreign competition to the Indian steel industry ceased. From 1 October 1939 to 30 June 1944, though there was control over steel prices in India for supplies meant for war requirements, there was no statutory control over commercial prices. From 1 July 1944, commercial prices were also brought under statutory control. A set of selling prices applicable both to war and non-war purposes was introduced. The manufacturers were, however, allowed separate 'retention prices' (as distinct from 'issue prices') for war and non-war supplies.

After the termination of the war there was no need for two sets of retention prices; and so from 1 April 1946 only one set of retention prices has been in force.

Retention prices have been generally lower than selling prices; and with the surcharge, i.e., the difference between the selling and retention prices, which is refunded to the Government by the producers, a fund, known as the Equalization Fund, has been built up, mainly to subsidize imports. It was decided to utilize this Fund also to make repayable advances to steel producers in India in connexion with their expansion programme. Its intrinsic soundness as a financial measure is not its only merit. As a check on inflation, it has been invaluable.

The task of the Tariff Board has been by no means easy. In view of the fact that the three main steel producing units were 'unequal in size, equipment, financial resources, technical experience, and natural advantages enjoyed, it was felt that the only practicable and equitable method of price fixation was to have a differential retention price for steel produced while fixing a uniform sale or issue price for steel to consumers in all parts of India including the acceding States'. Such a method of price fixation, it was felt, 'would be quite fair to each of the units concerned and at the same time entail the least possible burden on the consumers of steel'.

The Board had to take account of a multiplicity of similar but

different products, of variations in methods of production between one manufacturer and another, and in technical and working conditions between one area and another. Costing was no less complex. It had to reckon with factors like depreciation, interest on working capital, return on block, head office expenses, selling expenses, extra cost of coal and margins for contingencies, overheads, and manufacturer's profit. It was a courageous attempt to go beyond the usual fixing of arbitrary margins for wholesale and retail business and to extend control back to the process of manufacture.

Recent increases in retention prices have been the subject of much comment. The consumer has welcomed the general insistence by the Government that the special depreciation allowed should be set apart and used for implementing the programme of renewal, replacement and extension of plant, and that no part of it should be utilized in or towards payment of any dividends. In the case of Tatas, as the Tariff Commission had taken credit for certain receipts from sales of sulphate of ammonia in working out costs, it was thought illogical that the Government should not agree to any loss that may be incurred in the commodity being adjusted with the Equalization Fund.

Another point vigorously pressed is that, as the recommendation of the Tariff Commission for raising the rate of return on capital by 20 per cent was based on a mature consideration of the various factors involved, (viz., basic character of the steel industry, the importance of maintaining a steady rate of expansion, the large capital expenditure which the companies have undertaken, the resources at present available to them for the purpose, and present conditions in the capital market) loan assistance could not be considered a proper substitute for a reasonable rate of return on capital investment. Indeed it is contended that a gross return of 8 per cent on capital expenditure, leaving a net return of only about $3\frac{1}{2}$ per cent, was totally inadequate to build up sufficient reserves or to attract fresh investment in the industry for modernization and expansion of plant. In retrospect, it seems that had the retention prices recommended by the Tariff Commission been sanctioned, the industry might, if asked, have agreed to use them either for reducing the total amount or accelerating the repayment of the loans granted. Reduction in the rate of retention prices recommended by the Tariff Commission, it is argued, retards the continued liquidation of liabilities, finance for which has to be found from earnings.

Iron and Steel Control

The scarcity of steel and the fear of an inflation of selling prices, possible in a free economy, led during World War II to the creation of a central controlling organization. Iron and steel control came

into existence in 1941 and has been in operation under the overall direction of the Ministry of Industry and Commerce.

The prices of imported iron and steel are fixed with reference to corresponding qualities manufactured in India. Imports of iron and steel articles whose prices exceed the price of similar articles of indigenous manufacture by a substantial margin are not permitted. A rise in price is authorized only after a careful analysis of costing by the authorities. The system forms, as it were, a guarantee against wild fluctuations in the steel trade.

A detailed examination of the costing system is not possible here but it can be confidently asserted that in neither case is there any plan for pooling profits or subsidizing the less efficient at the expense of the more efficient producers. Some commonly abnormal cost factor affecting all forms (e.g. an increase in freight rates independent of the rates of profit made or loss sustained by individual firms) is the only criterion for consideration. Any inflationary tendencies in the steel trade are thus effectively curbed.

Production is also planned by the Iron and Steel Control. As far as possible, advance information is given to the producers of the extent and the nature of the demands likely to be made upon them; and this has helped to encourage the manufacture of the products in greatest demand. At any rate, it has eliminated the danger of production of goods in the wrong proportions.

Articles of manufacture have in the main been : structurals, bars, rods, plates, steels—black and corrugated—rails and fishplates, railway fittings, tinplates, wire, castings, nails, nuts and bolts and ordnance. The main producers are under contract with the railways for supply of material, and the record of Indian iron and steel as railway material is eminently satisfactory. Material supplied is not accepted for use until it has passed official technical tests in respect of strength and durability.

The reaction in the civilian market, however, has not been equally favourable. Doubts still exist in some quarters as to the durability of Indian steel, and there is a marked and largely unreasonable predilection for steel of foreign manufacture. Steel experts attribute this largely to prejudice. Stabilizing and strengthening its position in the internal market is hence one of the primary tasks that the Indian iron and steel industry will have to tackle. Competition in the international field is very much a matter of the future, for the industry is yet unable to meet certain American and British specifications in respect of tolerances and heat treatment.

The production plan is adjusted to the demand, and priorities as between the requirements of different consumers are determined in

relation to the capacity of the main producers. Distribution is on the basis of total availability, both indigenous and foreign. Allocations to provinces, departments of the Government and industries are determined by the Ministry of Industry and Supply. A quota-holders' meeting is held every three months at Delhi and demands for supplies are made by the representatives present. Defence requirements are, of course, given high priority. The original plan for control has undergone various minor modifications inspired by practical experience. In the continuing disequilibrium between supplies and demand, a reversion to uncontrolled distribution might create complete chaos. It is not possible to assess the success of control in terms of precise statistics, but there has been very little attempt to repudiate the need for some form of controlled distribution. The continuance of the organization thus seems well justified.

As compared with 10,97,000 tons in 1952, allocations of steel in 1953 amounted to 12,89,000 tons. Details of distribution are given below :

				(Allotment in tons)	
				1953	1952
<i>Government Demands</i>					
Defence and Railways	...	...		1,50,000	1,67,000
Government Development Schemes (including House Schemes and Community Projects)	...	...		2,23,000	1,53,000
House Schemes for Displaced Persons	...	...		26,000	24,000
<i>Private Demands</i>					
Industrial Maintenance and Packing	...	...		92,000	1,06,000
Steel Processing Industries	...	...		3,13,000	2,87,000
Private Industrial Development Schemes	...	...		49,000	58,000
Agriculture	...	...		1,15,000	1,33,000
				Plus	
States	...	...		42,000	
				Plus	
				87,000	1,19,000
				42,000	
Total				11,39,000	10,47,000
Plus				1,50,000	50,000
Grand Total				12,89,000	10,97,000

In April 1952, with a view to relieving the congestion in the godowns of dealers and re-rolling mills, the Government of India announced that registered stockists in all the States could sell, without permit, steel which was in their possession on 1 January 1952 but had not so far been released by the State authorities.

In July 1952 the Government of India decided to remove the control on the distribution of heavy structural steels and heavy rails normally used in the construction of large buildings, factories, bridges and power projects. India's current production of these steels, it is believed, will be able to meet the country's requirements. Latterly there has been a recession in the demand for these steels.

Private consumers can now obtain their requirements of these steels direct from the producers, and Government departments through the Iron and Steel Controller, Government of India.

In September 1952, registered stockholders in the various States were allowed to sell without permits, but at controlled prices, such of their stocks of iron and steel, including pipes, as were not 'lifted' by consumers within 60 days from the date of receipt. In January 1953, in view of the relatively poor offtake of bars, rods and high structurals, control over distribution by all registered stockholders (retail dealers) was removed; also control over the distribution and prices of all varieties of iron and steel pipes and tubes, which were mostly imported and supplies of which at reasonable prices were freely available from abroad. In August 1953, the permission given in September 1952 for the free sale by registered stockholders was withdrawn in respect of sheets and plates only, as the State Governments reported that owing to the difficult supply position of sheets, this permission was sometimes being abused.

As regards the allotment for agriculture, mention must be made in this context of the Agreement between the U.S.A. and India entered into in November 1952, providing for supply of iron and steel at a joint cost of \$8.5 millions and Rs. 32.36 lakhs. Under this agreement, 55,000 tons of iron and steel were to be supplied by the U.S.A. to India. Of these, 39,000 tons were to be distributed to blacksmiths and farmers and 16,000 tons to farm implement factories. The iron and steel imported under this Agreement was to become part of the iron and steel pool of India.

That the demands in 1953 from the Defence Services and the Railways were met in full, and those from development schemes (both private and Government) mostly, is gratifying; also that, in accordance with the recommendations of the Commodity Controls Committee, the allotments for steel processing industries were augmented.

Iron and Steel Consumption

Unlike output, which has steadily increased, the volume of steel consumption, depending as it does on the level of investment, price and availability of supplies, has shown marked fluctuations. Home consumption has been variously estimated. In 1946 the Iron and Steel (Major) Panel assessed future offtake at 2 million tons. The Advisory Planning Board, reporting in 1947, thought that estimate on the high side and put the normal demand at about 1.5 million tons. In April 1950 the Sub-committee on Iron and Steel of the E.C.A.F.E. estimated that consumption would rise to about 2.9 million tons by 1954. On

the basis of actual demand as screened by the Government, it was estimated that 'unscreened' requirements came to about 2.3 million tons in 1952 and that by 1957 they would reach about 2.8 million tons. As an increase in output adequate to meet demand, and imports at reasonable prices, are not likely for some time yet, home consumption may have to be restricted for a few years more.

In the circumstances, restriction of iron and steel scrap exports to those varieties which this country cannot use is a welcome measure ; and hardly less so is the stipulation that 'for every four tons exported one ton of usable melting scrap should be delivered to indigenous furnace owners at the statutory price'. But for optimum benefits, this needs to be supplemented by active encouragement of the use of maximum quantities of scrap steel in existing factories. It is learnt that permission is now being freely given to extend existing electric furnace capacity or to instal new furnaces.

According to expert opinion, structural engineering in India, by the continued use of uneconomic sections and the adoption of outmoded designs and building practices, wastes more than 25 per cent of its allotment of steel. Even with the present restricted use, waste is estimated at over 1,50,000 tons involving annually, based on the value of imports, a loss of about Rs 8 to 9 crores. A Structural Steel Sectional Committee has been formed to study and make recommendations on the economic use of steel.

An important trend in the pattern of steel consumption is the increasing offtake of steel goods manufactures ; and this trend is likely to widen and intensify as a result of industrial development. Both at home and in neighbouring countries Indian steel goods are rapidly gaining ground. But success in trade abroad will depend mainly on relative prices. The steel goods industry might, it seems, do more itself, particularly in the export field, to widen the demand for its products through market research and a reconsideration of its pricing policy.

With the contemplated rehabilitation of railway equipment, the implementation of river valley schemes, improvements in road transport, the expansion of the shipbuilding industry and modernization of the equipment of the Armed Forces, the demand is bound to increase both in volume and urgency. Potentially the Indian market for iron and steel is one of the biggest in the world. The industry has access to a large internal market covering the whole country with no customs barriers between its different parts.

Unsettled political and economic conditions and the shortage of transport and manpower prevailing in many parts of Europe have reduced the possibility of imports at competitive rates to the minimum, and the devaluation of the Indian rupee has resulted in an increase in the

prices of goods from non-sterling areas. Further, in some countries any exportable surplus would in all probability be used for the rehabilitation of their own industries which were badly damaged during the war.

In the main, it would seem that India is likely to suffer less from the repercussions of overseas gluts than from the persistent pressure of internal shortages. But there are other factors in the equation. Competition from countries which were, from the point of view of material destruction, unaffected during the war, e.g., America and Australia, is a possibility that it would be unwise to ignore. The cost of production of steel in Australia is said to be the cheapest in the world, and latterly there has been a distinct downward trend in the price of steel in the international market.

It is impossible to be sure even now that the steel price situation in the country is proof against sudden reversal. Against foreign competition, the products of the Indian iron and steel industry might not be able to retain their hold on the internal market. The industry might again have to seek protection from the Government; and although in all probability the protection would be given—an assurance of protection should the necessity arise was one of the main recommendations of the Tariff Board of 1947—the assumption that steel can be sold irrespective of its local cost of production is potentially dangerous.

Hence, in the words of Sir Jehangir Ghandy, 'waste has to be eliminated; cost will need to be cut down; and the highest possible efficiency has to be achieved'. And there is above all the human aspect—the need for bringing the products of the Indian iron and steel industry within the reach of the bulk of the people whose purchasing power, which has never been high, is likely to remain at its present low level for some years yet.

Transport

Difficulties over transport have in the main been on the distributional side of the industry as apart from the manufacturing. The transport of coal or iron ore from the mines to the factory has largely been in the hands of the producers themselves. Tatas, for instance, have their own locomotives and so have SCOBs. Difficulty, it appears, is being experienced in transferring the manufactured product from the factory to distribution points, particularly over the metre gauge. Government is not unaware of this bottleneck in the course of supply, but owing to other preoccupations attention has not been paid to it as much as might have been desired.

The high cost of transport, apart from its availability, which has never been fully satisfactory, is a factor impeding production. The Mysore Iron and Steel Works at Bhadravati have been constrained to use charcoal for their operations—the resultant deforestation of the area can well be imagined—as the cost of transport of coking coal from the North has been prohibitive. Indeed large deposits of iron ore in South India lie undeveloped, for the cost of bringing coal to the region has frightened even the most speculative investor. Transport by sea, it is feared, would be worse from the point of view of cost. There has been for some time an insistent demand from the industry for a revision of the railway freight rates as an aid to increase production. It has yet to be adequately met.

The transport requirements of steel, textiles and cement were finalized in March 1950 at special meetings of the Standing Committee of the Central Board of Transport. In accordance with the recommendations of the Board, the Government accepted that certain national priorities or objectives should be satisfied in full by complete transport provision, and that transport should subserve the achievement and maintenance of full production and distribution in industries accepted to be of national importance. This decision was implemented with effect from 1 January 1949 and covered, to start with, iron and steel, textiles and cement, the three basic industries.

The expansion of the industry would call for the provision of additional transport facilities for both raw materials and finished products. It is estimated that these additional requirements would cost between 10 and 12 crores of rupees. Pilferage of pig-iron in transit is on the increase and at times runs to a high figure.

Prospects

The present is said to determine the future.

There is a growing realization by the State and the industry itself that on the wise use of the country's reserves of iron ore and coal will largely depend the progress of Indian industry.

The baneful psychology engendered by a continuing seller's market has been effectively countered by State control over the production and sale of iron and steel ; and control must, and probably will, continue as long as conditions of scarcity persist.

There is evidence of effort to secure 'the most efficient utilization of steel-making capacity in the country'. 'Economic integration of the steel industry' is the objective. It is always tempting to argue the case for or against the private sector. But that stage is now past. A mixed economy is coming into being. Hindustan Steel Ltd. will have to reckon

with Government powers of direction in many matters affecting production, prices and trading policy. But this position is not entirely new because Indian industry is already under control in several respects. Establishing the unit will in itself be a complicated task ; and hard upon it will come the necessity of co-ordinating production with the private sector. Many observers will withhold judgment on the merits of what is being done. But the development is, like so many other processes in India, not a revolutionary one.

Production of iron and steel in India for some time past has been steadily on the increase ; and with the proposed expansion of the operations of the three main producers and the construction of a Government steel factory, still larger output should be possible.

The country's needs of steel as a constructional material and in the form of manufactures are large. The increased output has been absorbed by a very large internal capital development programme and by the needs of the export industries. The main trouble has been that a limited amount of steel has had to be spread over a multitude of urgent and essential tasks. With the completion of the various expansion programmes, the spread will not be so thin. Indian producers will be able to meet a larger share of home requirements. However, the respective emphasis on home production and imports should not be exaggerated, particularly as there is no certainty that present patterns of demand will continue indefinitely.

There is abundant manpower, and technical training schemes in operation augur well. Happily, Indians are quick to learn new techniques. They proved their worth during the trying times of two wars. The Howrah bridge made of Indian iron and steel (a Tata triumph) and built by Indian labour, is a spectacular example of the people's potentialities.

Increase in the scientific knowledge of metals and coal is significant, and experiment and research are being steadily pursued.

Possibilities of increased production of electric energy are promising. Hydro-electric schemes are being developed. Hopes are gradually becoming expectations.

Imports of capital equipment during the last few years have been singularly heartening, and as all possible facilities for such imports are being offered by the State, the indications are that, subject to availability, there will be continuing increase on this account for some years.

The position of the ancillary industries *vis-à-vis* the basic industries is gradually improving. Dependence on primary producers is diminishing and working agreements between the two seem possible in the near future.

The three main producers of iron and steel and many of the ancillary

industries are progressive concerns and, within the limits of their operations, sympathetic to the aspirations of labour.

A wide internal market—and a rapidly expanding one at that—with no customs barriers between zones is yet another asset.

The door is open to foreign capital. Far-sighted foreign investors may find the natural advantages which India possesses for the manufacture of iron and steel, together with the stability of its Government, attractive.

The Government of the country is aware that industrialization is both a military and an economic necessity, and that it is only by judicious control over and conscious direction of industrial enterprise that the highest standard of social justice can be achieved.

What conclusion can be drawn from all this? It is permissible to conclude that there are in the Indian iron and steel industry unmistakable indications of progress. The vision for the future is bright.

CHAPTER II

THE NON-FERROUS METALS INDUSTRY

THE development of Indian mineral resources is not a new idea. As early as 1864, commenting on a report by his assistants, William King and Robert Bruce, that :

'A few feet from the northern end of the limestone beds lay some loose blocks of a very dark green crystal ; in a fragment of this dark purplish-grey rock, a speck of a metallic mineral, apparently copper-pyrites, was found but no further traces of any metal were observed',

Mr. Thomas Oldham, the first head of an organized Geological Survey of India, remarked significantly, if humorously :

'At the earliest opportunity two assistants under the guidance of the Deputy Superintendent for the Madras Presidency will be specially deputed to revisit and report on this speck with a view to the development of its resources.'

Only in the last few years has there been an attempt at a quickening of pace, due principally to a rapidly growing demand and increasing recognition that the country could not for long afford massive imports of minerals. A mineral policy has been formulated. The objective is 'co-ordinated, orderly and economic development'. The Planning Commission has set out so strong a case for early development that unless the Government uncovers difficulties so far unsuspected, it can be assumed that the project will be put through. Indeed, the indications are that the Government has accepted the Commission's recommendations in their entirety. The Geological Survey of India is being expanded to facilitate the implementation of a programme of mineral exploration and development. Preliminary investigations are to be pressed ahead with all convenient speed. A Bureau of Mines has been established 'to secure co-ordinated development with due regard to the conservation of the country's mineral assets'. A Mineral Advisory Board has been set up to ensure 'the conservation, scientific exploitation, and development of mineral resources as well as the promotion of the Indian mineral export trade'. Financial provision has been made in the Five-Year Plans for both quantitative and qualitative assessment of the country's reserves of important minerals.

Metals form an important part of India's mineral assets. Broadly, they may be divided into three groups : those for which there is an abundant supply of ore (e.g. aluminium, magnesium, gold, iron and steel, manganese, chromium and titanium) ; those for which the ore

is in short supply (e.g. copper, lead, zinc, silver, tungsten and vanadium) ; and those for which the relative ore is almost non-existent—at any rate not known to exist (e.g. antimony, cobalt, nickel and tin). Our concern here is primarily with developments in aluminium, antimony, copper, lead, manganese, nickel, tin and zinc.

To state that the contribution of the non-ferrous metals industry to a country's economy is considerable is perhaps trite, but true. Each of the main non-ferrous metals—aluminium, antimony, copper, lead, tin and zinc—serves as a base for a number of alloys. Nothing short of a catalogue of modern industry would suffice to indicate their varied uses. And in time of war they assume adventitious importance. For munitions production they are almost indispensable.

Aluminium

Aluminium is essentially a modern metal. A century ago, it was a largely theoretical product of the laboratory. Commercial production began within living memory.

Among its most important properties are lightness, immunity from chipping and burning, resistance to corrosion, malleability, reflective power, and thermal and electric conductivity.

The earliest use of the metal was in the manufacture of pots and pans ; even in this field it was for some time viewed with distrust. As manufacturing processes improved the metal proved its worth. Industry was not slow to perceive the innumerable ways in which its several properties could be profitably utilized. Now, apart from manufacture into hollow-ware, it is used as a building material (prefabricated aluminium houses costing £100 are being produced in the U.K. at the rate of nearly 1,000 a month) ; pigment in paint ; structural material for vehicles, railway coaches and aircraft ; packing material for chocolates, butter, cigarettes, etc. ; a conductor of electricity, e.g. cables and fan blades ; lining for tea-chests ; and in the manufacture of tanks, pipes and containers for the chemical industry. Alloying opens up an even wider range of utility.

In recent years, aluminium has entered new fields of utility ; perhaps because its use in containers has reached an economic limit. Indeed, in certain spheres it is rapidly replacing steel. For instance, in the motor industry this light metal is likely to make headway as a sheet-metal for bodies and in chassis and engine castings ; and in building and civil engineering, aluminium has been found suitable for scaffolding, window frames and roof coverings. Britain has built about 400 aluminium school buildings in different parts of the country and has exported more than 600 such buildings to Australia and New Zealand. Similar buildings, it is reported, have been supplied to countries in all parts

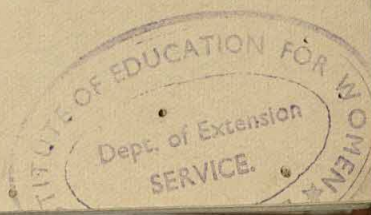
of the world for use as hospitals, telephone exchanges, post offices, air terminals, industrial laboratories and for a wide range of other purposes. Aluminium coins are in use in Austria, France, Germany, Japan, Italy, Monaco, Spain and the Lebanon. The storage of grains in aluminium bins started in North America several years ago, and has been found to have several advantages (e.g. portability, easy assembly, strength, durability, freedom from rust, protection against pests and rains, and freedom from maintenance) over other forms of food preservation. The Government of India has decided to experiment with four Indian-made prototypes, each with a capacity of 1,000 maunds, in four climatically different parts of the country to verify their suitability for Indian conditions. The Indian Standards Institution has been asked to report on the condition of these bins after a year. The experiment is welcome as about 5 per cent of the country's grain output is lost every year owing to improper storage.

Among the non-ferrous group, aluminium is by far the most important; at any rate for India. It is the only one of that group whose development was incorporated in the First Five-Year Plan.

The reserves of bauxite in India, inclusive of all grades, are estimated at 250 million tons. High-grade reserves, as recently estimated, are between 25-28 million tons. Detailed proving has been done only in a few deposits leased to the manufacturing companies. Reliable estimates are obviously impossible till all the deposits have been carefully investigated and the characteristics of the ore from each large deposit determined. This is a task to which the Geological Survey of India seems likely soon to address itself. Reserves of this size obviously merit development. In other words, there is every incentive for India to stimulate aluminium production within its borders.

To Travancore-Cochin must go the credit for starting manufacture. In March 1943, the State produced aluminium, using imported alumina. Soon after—by July 1944—the use of home bauxite for manufacture commenced in the country.

There are two aluminium manufacturing units in the country: the Indian Aluminium Co. Ltd. and the Aluminium Corporation of India Ltd. The former has its bauxite mines at Lohardaga in Bihar, ore-refining plant at Muri in Bihar, reduction works at Alwaye in Travancore, and rolling mills at Belur. The latter has its mines in Lohardaga. Its equipment includes an ore-refining plant, reduction works, power house and a rolling mill—all located in Jaykaynagar near Asansol. The two plants together have a total capacity of 4,000 tons of aluminium ingot per year, the plant of the Indian Aluminium Company at Alwaye accounting for 2,500 tons, and that of the Aluminium Corporation of India at Jaykaynagar, for 1,500 tons. The rolling mill capacity of the



two concerns is assessed at 2,500 tons. The capacity of the alumina plants is 12 to 15 thousand tons. Up to 1949, much of the alumina used in the manufacture of aluminium was imported. Since 1950, alumina is being produced almost entirely from Indian bauxite.

Production in recent years has been :

Year	Unit of Accounting	Installed Capacity	Production
1950	Tons	4,000	3,596
1951	„	4,000	3,848
1952	„	4,000	3,566
1953	„	4,000	3,758
1954	„	7,000	4,885

Deposits in India of bauxite—the ore of aluminium—are widely scattered but occur mainly in the Ranchi and Palamau districts of Bihar, the Belgaum, Khairā and Thana districts of Bombay, the Jubbulpore, Balaghat, Mandea and Bilaspur districts of Madhya Pradesh, the States of Rewa and Bhopal, Raishi and Poonch Districts of Kashmir, the Salem district of Madras and the Bababudan Hills of Mysore. The location of new plants seems possible in the Hirakud area in Orissa, the Salem District in South India, Rihand dam area in Uttar Pradesh, and the Belgaum area in Bombay.

For the production of one ton of aluminium approximately 13 tons of raw material are required, made up as follows : bauxite 5 tons ; coal 6 tons ; lime 0.5 tons ; petroleum coke 0.5 tons ; pitch 0.25 tons ; soda ash and caustic soda 0.3 tons ; cryolite 0.1 tons ; aluminium fluorides 0.05 tons ; fuel oil 0.3 tons ; filter cloth 10 yds. ; hard coke 0.5 tons.

Supplies of coal and coke are satisfactory. Lime comes from deposits in Madhya Pradesh and Bihar and supplies are regular. The only source of petroleum coke in India is Digboi. While supplies are generally available, it is difficult to get wagons for the long haul from Digboi. Pitch is obtained from the collieries and there is no difficulty in getting supplies. Cryolite and aluminium fluoride have to be imported as there are no indigenous sources of supply. Production of soda ash and caustic soda in India is limited. The aluminium industry is hence constrained to import part of its requirements of these commodities.

Production

The production of aluminium is an electro-metallurgical process and calls for a high degree of technical control. A 15,000-ton plant requires a block of about 40,000 kW. of power : and for every pound of metal

produced about 10 kW. of electricity are required. A regular supply of considerable quantities of cheap electrical power is a primary requisite. Canada's predominance in the world aluminium industry is based on the availability of cheap electric power. The electricity bill forms a large part of the cost of production. It was this factor which was chiefly responsible for the location of the Indian Aluminium Company's reduction works at Alwaye in Travancore, South India, though this meant adding to the already high cost of transport since Alwaye is remote both from the mines and the rolling mill in North India. To obtain adequate power cheaply continues to be a problem. The Government of India recommended the Government of Travancore and Cochin to extend all possible assistance. The present installed capacity of the power station at Alwaye is 28,500 kW. The Aluminium Corporation of India have a power station of 15,000 kW. near Asansol.

At the instance of the Ministry of Commerce and Industry the Indian Standards Institution has prepared a tentative Indian Standards specification for cast aluminium for utensils and another for wrought aluminium for utensils. These standards are intended to safeguard public health and increase the life of the utensils by keeping down pitting and corrosion to the minimum.

Against an estimated demand of nearly 12,000 tons a year in 1949, indigenous production amounted only to about 3,500 tons, i.e. about 30 per cent of requirements. The balance had to be imported. Total imports of aluminium into India during 1947-9 were (in tons) : 1947, 7,520 ; 1948, 7,053 ; and 1949, 8,300. Imports in 1950 amounted to 5,766 tons and 8 cwt.

About the demand for aluminium, there is a plethora of intricate estimates. The latest is by the Planning Commission in 1953 which put demand at 16,000 tons a year : 10,000 tons for utensils ; 2,500 tons for A.C.S.R. cables ; 2,000 tons for industrial sheets and the balance for defence requirements and miscellaneous purposes. Sheets and circles for the utensils industry continue to constitute the bulk of consumption. Current demand is assessed at 20,000 tons a year. Broken down, it is (approximately) in tons :

Utensils	8,000
A. C. S. R. and all-aluminium conductors	6,000/8,000
Foil stock for manufacture of foils	2,000
Industrial sheets for transport industries	2,000

It will be seen that output has been only about 25 per cent of demand.

Taking only a few items, which are severally so important in the manufacture of various consumer goods, imports of aluminium in recent years have been as follows (quantity in cwt. and value in rupees) :

Commodity		1951-2	1952-3	1953-4
Aluminium, unwrought (ingots, blocks, bars, etc.) ...	Q.	50,223	23,731	14,641
	V.	52,09,759	33,50,805	11,27,225
Wrought aluminium (circles and sheets) ...	Q.	58,903	17,027	16,968
	V.	99,54,042	31,55,882	28,89,324
Tubes ...	Q.	—	—	986
	V.	—	—	6,45,654
Other manufactures (not elsewhere specified) ...	Q.	76,559	80,019	76,471
	V.	1,65,76,951	1,75,26,644	1,33,89,348
Total of Aluminium ...	Q.	1,85,685	1,20,777	1,09,066
	V.	3,17,40,752	2,40,33,331	1,80,51,551

It will be seen that as the Indian output rose, there was, in inverse ratio, a similar big difference in the amount imported. In the last few years, imports have averaged 7,000 tons valued at about Rs 2½ crores a year.

Increasing production has been impeded chiefly by the shortage of some of the important raw materials and electric power. In January 1953 it was reported that the National Metallurgical Laboratory, Jamshedpur, had evolved a method for 'recovering cryolite from the carbon dust produced by the disintegration of electrodes in aluminium reduction furnaces'. Data are not readily available to determine the extent to which availability at home has thus been achieved. The size of neither of the existing plants is economic. With its widely scattered units, the Indian Aluminium Company is finding the cost of transport particularly heavy. The counterpart of this in the Aluminium Corporation of India is perhaps the high cost of thermal power. All this notwithstanding, development there must be, if only because aluminium is the only non-ferrous metal of which the country has adequate ore deposits.

The Planning Commission has recommended that 'the capacity of the plant of the Aluminium Corporation of India should be increased so as to produce 5,000 tons of ingots per annum ; that facilities should be afforded for the implementation of the expansion plan of the Indian Aluminium Company or for any alternative project designed to bring into existence additional capacity for production of 10,000 to

15,000 tons of aluminium per annum; that the petroleum refineries should include in their manufacturing programme the production of calcined petroleum coke required by the aluminium industry; and that arrangements should be made to ensure regular and adequate supplies of cryolite which has to be imported.' Self-sufficiency is being sought. The balance of 80 per cent of demand is to be found by expanding the capacity of the existing plants as well as by establishing new reduction works.

The industry is working to the following programme of development :

Unit	1950-1	1955-6
Number of smelters	2	3
Installed capacity (tons)	... 4,000	20,000
Production	... 3,677	12,000

The increase in capacity to 20,000 tons is to be achieved by the expansion of the two existing plants to 5,000 tons each, and by the installation of a new unit at Hirakud with a capacity of 10,000 tons.

Progress during the years 1951-4 is summarized below :

Annual Rated Capacity (tons)		Actual Production (tons)	
1950-1	4,000	1950-1	3,677
		1951-2	3,905
		1952-3	3,420
1953-4	4,000	1953-4	3,846
		1955-6	12,000
1955-6	20,000	(Target)	

The existing smelting capacity at Alwaye (The Indian Aluminium Co. Ltd.) has been doubled (from 2,500 tons of aluminium ingots to 5,000 tons) at a cost of Rs 30 lakhs. A scheme for the setting up of a new aluminium smelter at Hirakud with an initial capacity of 10,000 tons, to be ultimately raised to 20,000 tons per year, and a rolling mill with a capacity of 6,000 tons per year has been licensed under the Industries (Development and Regulation) Act. On behalf of the Indian Aluminium Company, a technical mission has completed a survey of the possibilities of development of the aluminium industry in that area. On the basis of the Mission's recommendations the Company has formulated the following programme of development :

- (a) Establishment by early 1956 of a smelter with an annual capacity of 10,000 tons per annum; and

- (b) Expansion of mining at Lohardaga to 80,000 tons and of alumina production at Muri to 30,000 tons per annum by the end of 1958.

The survey was an important step ; it meant that the scheme had the *cachet* of an independent technical and commercial investigation. Although the designs for the unit at Hirakud have been finalized, the implementation of the scheme has had to be slowed down to synchronize with the availability of power from the Hirakud project. Since power is not expected to be available during the period of the Plan, the new aluminium smelter is not likely to go into production before April 1956. The first stage of the expansion of the plant of the Aluminium Corporation from 1,500 tons to 2,000 tons was completed in August 1954. The second stage is held up for want of finance.

The schemes under implementation envisage a programme of related development. About Rs 143 lakhs were invested during the years 1951-4.

The present installed capacity for aluminium sheets, circles and strips is about 9,560 tons per year, and that for aluminium foils, 1,200 tons. The statement below summarizes the situation during the years 1952-4 :

	1952	1953	1954
<i>Aluminium Sheets</i>			
<i>Circles and Strips</i>			
Number of factories	8	9	11
Capacity (tons)	8,000	9,200	9,560
Production (tons)	4,927	5,263.08	7,616.46
<i>Aluminium Foils</i>			
Number of factories	—	1	1
Capacity (tons)	—	1,200	1,200
Production (tons)	—	540.82	945.5

Annual requirements are assessed at 12,000 tons. Both the Indian Aluminium Company and the Aluminium Corporation of India have plans, approved by the Government, for expansion.

Less important perhaps yet notable, the production of aluminium powder has commenced ; annual capacity is assessed at 300 tons. Aluminium powder, required for the manufacture of aluminium paints, was till recently entirely imported. Domestic production is now adequate to meet a substantial part of the Indian demand. In 1947, a firm in Calcutta installed a plant for the manufacture of aluminium foils for tea-chest linings. This plant has now capacity (1,200 tons) adequate

to meet the entire current demand (about 600 tons) of the country for tea-chest linings. Additions have since been made to the plant; and the company is now able to manufacture also foil of .008 mm. to .009 mm. thickness for packing cigarettes.

The successful completion of all these schemes would guarantee to the Indian consumer additional supplies of aluminium at competitive prices to meet the rapidly growing requirements for which it would be unwise to rely on other sources. Annual requirements by the end of the Second Five-Year Plan (i.e. 1960-1) are assessed at 30,000 tons; the increase, it is expected, will be largely due to more extensive use of aluminium in high-tension and low-tension transmission lines, in the manufacture of utensils and in industrial fields, viz. transport, construction, automobiles, aircraft, etc. Cheap electric power is obviously the key to increased production. When it is available, exploitation of other bauxite deposits should be possible. But the deposits will need to be reasonably near the source of electric power for operations to be economic. India's hydro-electric resources are immense; and they are being developed. Hydro-electric schemes can be justified only if there is a large demand for cheap power over which the huge investment can be depreciated. That demand the bauxite smelters both in, and coming into, being will no doubt in substantial part provide. For instance, the factory to be set up in the Hirakud area will require initially about 25,000 kW.; and if its capacity is doubled, the demand for electric power will increase in proportion.

Exports there have been; but only in small quantities, mostly in the form of aluminium ware to the Far East. Of ingots and ingots and sheets there is virtually no export. The statement below summarizes sea-borne exports in recent years:

Commodity		1951-2	1952-3	1953-4
Aluminium				
Bauxite and other aluminium ore	tons	1,458	4,261	2,705
	Rs	1,45,390	3,26,724	3,15,670
Unwrought	cwt.	—	229	108
	Rs	414	62,764	419
Wrought	cwt.	16,585	18,198	26,314
	Rs	49,37,858	55,94,200	87,14,866

And by land, exports have been:

Aluminium and manufactures thereof	cwt.	—	591*	—
	Rs	—	2,00,340	2,200

*Incomplete

Clearly for a long time yet, the Indian manufacturer will have little chance of survival in overseas markets against competition from Canada,

the U.S.A. and the U.K., with their substantially lower cost of production.

Expansion under the Plans notwithstanding, India, as will be seen from the table below, is not likely to be one of the world's major producers for many years yet :

ALUMINIUM

(Figures in tons)

	Average production.	Average imports	Average exports	Average quantity available for consumption
U.S.A. ...	5,99,959	26,29,114	2,18,613	31,10,460
U.K. ...	29,301	4,17,623	93,247	3,53,677
CANADA ...	3,35,219	17,01,608	2,90,107	17,46,720
FRANCE ...	63,593	14,875	2,90,003	...
GERMANY ...	27,275	2,64,571	37,912	3,53,934
JAPAN ...	18,220	1,84,211	...	...
INDIA ...	3,505	9,560	...	13,065

State Protection

To State protection may be attributed in the main the growth of the industry. The case for protection was first referred to the Tariff Board for investigation in February 1946. Reporting to the Government in June that year, the Board recommended both a protective duty on imports and a subsidy to the home producer. A technical committee was appointed subsequently to re-examine the question. The committee agreed generally with the recommendations of the Tariff Board. The Government of India decided to subsidize the two aluminium-producing companies in India to the extent of the difference between the fair selling prices of their products, having regard to their respective costs of production, and those of similar imported articles, and to impose enhanced duties on imported articles from 15 May 1949.

Rates of subsidy fixed were :

Year.	Commodity	Indian Aluminium Company	Aluminium Corporation of India
1949-50	Sheets and Circles	Rs 330	Rs 710
	Ingots		Rs 900
1950-1	Sheets and Circles	Rs 230	Rs 610
	Ingots		Rs 825
1951-2	Sheets and Circles	Rs 130	Rs 510
	Ingots		Rs 750

The following duties (rupees per ton) were imposed on imports :

Commodity	1949-50	1950-1	1951-2
Ingots . . .	328	237	146
Sheets, strips and circles . . .	121	46	nil

These were to be in addition to the general revenue duty of 30 per cent *ad valorem*.

This scheme of protective duty-cum-subsidy, which was to be in operation initially for a period of three years, was again reviewed by the Tariff Board in 1951. The Government of India's resolution dated 12 July 1951 on the Tariff Board's Report stated that the existing protective duty of 30 per cent *ad valorem* would continue till 14 May 1952, before which date the question of continuing or modifying the scheme of protection would be reviewed. Having regard to the increase in the price of imported aluminium, the levy of additional specific duty on aluminium ingots, sheets and circles has been discontinued. The rate of subsidy on the sale of ingots payable to the Aluminium Corporation of India was reduced to Rs 120 per ton and that, too, payable only up to the end of October 1950, no subsidy being payable from 1 November 1950. No subsidy at all was paid to the Indian Aluminium Company for the period 15 May 1951 to 14 May 1952. The concession granted to Aluminium Industries Ltd., by way of a refund of duty in excess of 30 per cent on aluminium rods for A.C.S.R. cables, and the existing rate of drawback of duty (7/8 of import duty paid) on exports of aluminium products was, however, to continue. Later Government notifications extended protection to the aluminium industry up to 31 December 1954.

Between sections of the industry there is considerable divergence of opinion as to the merits of the protection scheme. Emphasis has in the main been on supply and price factors. On one point, however, they are agreed : that Government has not gone far enough in the way of assistance. State loans to finance the expansion of production (as with iron and steel) have been suggested. Imported aluminium is cheaper, it is said, because India's plant is not fully developed. And there has been criticism of the limitation of profits. It is alleged that the cost of production has been on the increase and that the calculations on which the profit margin was determined have now no relation to present conditions. The high labour bill and the increased cost of imported equipment are cited as instances. The absence of provision in the cost structure for facilities kept idle through no fault of the producers is another point on which the industry has laid great emphasis. To keep the matter in proper perspective, mention must also be made of doubts

expressed in many quarters as to the wisdom of a 'high-priced aluminium policy'.

To achieve fair distribution and equalize prices, the Government of India formed the Aluminium Pool in March 1945. The Pool was responsible for the purchase of all scrap and ingots available in the country and for its distribution to the rollers, for supplies of aluminium semi-manufactures to fabricators, and for prices. A common price was arrived at by pooling the cost of imports and the price paid to indigenous producers. The price of the Indian product was fixed on the basis of the cost of production. The Pool was dissolved in May 1949, and with its dissolution the control on prices came to an end.

Antimony

Antimony, a silvery white, crystalline and brittle metal, imparts hardness and stiffness to several lead, tin and copper alloys. It is important in the manufacture of storage batteries, anti-friction bearing metals, type metals, lead sheets, lead pipes, table-ware and ammunition. The match industry uses antimony sulphide. Antimony oxide is used as a pigment.

There are small deposits of antimony in Lahaul (Kangra District, Punjab) and at Shagor in Chitral State. An estimate of total reserves has not yet been attempted. There have been reports of deposits of antimony sulphide ore near Raipur in Madhya Pradesh. Investigations in that area are part of the field programme of the Geological Survey of India.

The production of antimony in India is confined to one company—the Star Metal Refinery, Bombay, which has its refinery at Vikhroly. Installed capacity is about 900 tons per annum, which, if fully utilised, could meet the country's entire requirements of the metal.

Production commenced in 1941. Output rose from 56 tons in that year to 235 tons in 1947. Till 1947, the company's raw material, i.e. antimony sulphide ore, came from its mines in Chitral State, N.W.F.P. Since partition of the country, supplies from Chitral have ceased, and ore has been imported chiefly from Bolivia, Siam and the U.S.A. Supplies have been irregular. The company's annual requirement of antimony ore is about 1,200 tons. Production in 1948 amounted to 330 tons. In 1949, demand for the indigenous product fell owing to large imports of antimony, and production was only 99.6 tons.

In April 1950 the successful negotiation of a short-term trade pact with Pakistan raised hopes, so far unfulfilled, of a resumption of ore supplies from Chitral. There have been subsequent reports of an agreement between the Government of India and the Government of

Pakistan whereby Pakistan would meet the entire ore requirements of the Star Metal Refinery and India would supply an agreed quantity of refined metal in exchange. No such agreement has so far been concluded, and in the present circumstances, it does not seem likely.

The table below summarizes output in recent years :

	1950	1951	1952	1953	1954
Installed capacity (tons)	700	700	700	700	700
Production (tons)	375.6	327.6	181.2	130.15	539.05

The quality of antimony produced is reported to be satisfactory. In some forms, it is said to be superior to imported Chinese metal.

Before the war, China was the main supplier of the metal. A small quantity was also imported from the U.K. Ore supplies came from (besides Chitral) Burma and Bolivia. Since the war, imports of antimony have been largely from the U.K. and the U.S.A. Resumption of supplies from Burma would help greatly. In 1948 metal imported was 528 tons 2 cwt. and ore, 571 tons. There were no imports of metal in 1949. Ore imported amounted to 249 tons 17 cwt.

The table below shows imports in 1950 :

		(Tons)	
Antimony Metal from the U.K.	...	0	$\frac{1}{2}$
Antimony Metal from the U.S.A.	...	0	4 $\frac{1}{2}$
		0	5
Antimony Ore From Bolivia	...	255	10
Siam	...	46	0
USA	...	394	6
		695	16

Indian capacity and production in recent years are shown below :

	1951	1952	1953
Capacity (tons)	700	700	700
Production (tons)	327.6	181.2	130.8

So far as smelting capacity is concerned, antimony is perhaps the only non-ferrous metal in which India is self-sufficient.

The country's current annual requirements are assessed at 400 tons. Imports fill the gap between supply and demand ; and these in recent years have been :

Antimony	Quantity		Value
	Tons.	Cwt.	Rs
1951	...	12 0	56,379
1952	...	127 0	4,71,717
1953	...	4 4	11,965
1954	...	54 14	1,42,282
Antimony ore			
1951	...	753 1	7,88,820
1952	...	573 13	12,72,645
1953	...	33 1	23,352
1954	...	1,080 15	11,37,064

(Source : *The Eastern Metals Review*)

Imports will have to continue till adequate deposits of antimony ore are discovered in India.

The industry's case for protection was first examined by the Tariff Board in 1946. It was reviewed in 1949 and 1954. Among the more important recommendations of the Tariff Commission (1954) were :

1. Protection to the industry should be continued for a further period of two years, i.e. till 31 December 1956, with the existing protective duties of $31\frac{1}{2}$ per cent and 21 per cent *ad valorem* on antimony and crude antimony respectively.
2. As exports of non-ferrous scrap are reported to be taking place under the guise of metallic residue and dross, Government may examine the desirability of extending the ban on exports of scrap to metallic residue and dross also.
3. The Geological Survey of India should intensify their efforts to locate deposits of antimony ore within the country.
4. Government orders for antimony and antimonial alloys should be planned in an even manner.
5. The import control policy regarding the metal, while fully safeguarding the interests of the domestic industry, should be sufficiently flexible to avoid inconvenience to consumers.
6. The industry should be given necessary assistance in securing its requirements of soda ash.

7. The Star Metal Refinery should fix their selling prices on the basis of the current landed costs of imported antimony.
8. The Star Metal Refinery should try to maintain a reserve stock of at least 75 tons of antimony metal.

The Government accepted the Commission's recommendation that protection should be continued till 31 December 1956 at the existing rates of protective duties of $31\frac{1}{2}$ per cent and 21 per cent *ad valorem* on antimony and crude antimony respectively. Recommendations (2) to (6) were also accepted in principle; and the Government agreed to implement them as far as possible after some points of detail had been considered.

Copper

Ductility, tensility, resistance to corrosion and high thermal and electrical conductivity are the more important properties of copper.

The metal is chiefly used in the manufacture of electrical, telegraphic and telephonic equipment; in building construction as water piping; in ship-building; as railway equipment and as equipment for the chemical industry. Some machinery parts are made from copper. Other uses include kitchen utensils and coinage. It is used also in the production of a wide range of alloys.

The only copper deposits worked at present are those of the copper belt of Singhbhum district in Bihar. It is expected that in the present bored area there will be enough ore to sustain mining for a few years more. According to the Geological Survey of India, 'copper deposits exist in several other parts of the country . . . The more important of them were examined within the last five or six years by the Geological Survey of India and a few old workings cleaned up and sampled. They are in Sikkim, Garhwal, Rajasthan and Madras'. (Dr M. S. Krishnan) The Planning Commission recommended that detailed geological and prospecting operations should be undertaken in the areas mentioned below :

(a) The Singhbhum copper belt (Bihar)

(b) Khetri in Jaipur (Rajasthan)

(c) Darabo (Alwar, Rajasthan)

(d) Hazaribagh (Bihar)

(e) Gani (Madras)

(f) Almora and Tehri-Garhwal (Uttar Pradesh)

During the years 1951-3, geophysical investigations for copper in Singhbhum (Bihar) and Jubbulpore (Madhya Pradesh) were undertaken and completed. Among those investigated, the deposits at Khetri in Jaipur and at Darabo in Alwar are said to be promising. Total reserves are not known.

The Indian Copper Corporation, with mines at Mosaboni and works at Moubhandar, is the only copper producer in India. The ore is crushed at Mosaboni and sent by aerial ropeway, some $6\frac{1}{2}$ miles long, to the concentration plant at Moubhandar. The Corporation was established in 1924 and copper production began in 1928. In 1930, a hot-rolling mill was set up for the production of brass sheets for utensil manufacture, and in 1950, a cold-rolling mill was installed which enabled the Corporation to put cold-finished sheets on the market. The power station at Moubhandar generates power both for works and mines and has an installed capacity of 9,875 kW.

According to the latest report of the Corporation, the ore reserves show 'an estimated decrease of 32,225 short tons with an average reduced value of 2.51 per cent'. Compared with 34,48,795 short tons in 1952, current reserves are assessed at 34,16,570 short tons. Extraction of copper is done entirely by the fire-refined process. There is no equipment for the production of electrolytic copper. The country's requirements of electrolytic copper are met entirely by imports. The overall recovery of refined copper from ore in 1953 was 92.586 per cent against 93.123 per cent in 1952. Coal for power generation and zinc for the production of brass sheets are the two most important raw materials required. Coal supply is said to be satisfactory. Zinc is imported.

Labour employed is about 7,000. Of these, about 4,000 are employed at the mines and the rest at the works at Moubhandar. According to the Ministry of Labour, the average daily number of workers employed in mining in 1951 was 3,710; in 1952, 3,880 and 1953, 3,685. With the deepening of the mine, wages are likely to increase, and these, in turn, are likely to affect the cost of production. Indeed it may be necessary, as the Company observes, 'to revise the basis of estimating ore reserves'. Practically all the copper produced is converted into brass sheets and circles. The protective tariff on brass sheet imports and the duty-free imports of zinc enable them to withstand foreign competition in the Indian market for brass sheets.

Capacity and production in recent years are summarized below :

Copper (non-electrolytic)	Unit of accounting	1951	1952	1953	1954
Capacity	tons	7,200	7,200	7,200	7,200
Production	"	7,083	6,079	4,920	7,161

In the field of semi-manufactures, capacity and production in the last two years have been as follows :

Item	Unit of accounting	1953			1954		
		No. of factories	Capacity	Production	No. of factories	Capacity	Production
1. Brass and copper sheets, circles and strips	tons	19	52,300	11,676Δ	19	47,000*	17,374
2. Black copper rods, electrolytic	"		24,000	3,364	Nil	The unit has changed from non-ferrous to ferrous.	
3. Brass and copper wires for non-electrical purposes	"	4	1,958	245.61Δ	4	1,958	332.23
4. Brass and copper rods and bars (including arsenical copper rods, bars and sections)	"	5	5,477	540.41	5	5,477	1,371.31
5. Brass and copper pipes and tubes	"	1	360	46.35	1	360	20.55

Δ Considering the prolonged strike at the mine in 1953, output in that year must be thought satisfactory.

* Excludes capacity of two units which did not furnish details.

Self-sufficiency has been achieved in so far as brass and copper sheets and circles for the manufacture of household utensils are concerned. Indeed there is surplus capacity. Against estimated annual requirements of 25,000 tons, capacity is about 48,000 tons. The manufacture of strips of fine gauge has not yet begun.

Brass and copper wires made in India are said to be of a reasonably good standard, and brass sheets are comparable in quality with the imported product.

India, which at present produces only fire-refined copper, is soon to enter the electrolytic copper production field. A scheme for the installation of a silver refinery at Alipore, Calcutta, has been approved by the Government of India, which is to produce electrolytic copper as a by-product. The initial and ultimate targets of production are 3,600 and 10,000 tons per annum respectively.

Viewed against the background of output in other producing countries, figures for which are given below, Indian production is insignificant :

(Figures in tons)					Average quantity available for consumption
Country	Average production	Average imports	Average exports		
U.S.A.	8,52,867	4,71,593	1,80,149		11,44,311
U.K.	...	3,49,936	87,154		2,62,782
CANADA	1,96,952	3,458	1,53,985		46,425
FRANCE	293	1,32,738	15,121		1,17,910
GERMANY	85,801	9,17,112	29,826		9,73,087
JAPAN	34,940	190	27,661		7,469
INDIA	6,376	30,640	102		36,914

(Source : *Indian Minerals*, Vol. VII, No. 4.)

In the circumstances, it seems necessary to hark back to the recommendations of the Industrial Panel on Non-ferrous Metals Industries. The Panel recommended :

1. Immediate and thorough prospecting and exploratory work of the promising copper-ore deposits in India.
2. Import of copper-ore concentrates free of duty.
3. Subsidy to the indigenous producers of virgin copper if the cost of production is higher than that of imported virgin copper.
4. Import of copper and copper alloy scraps free of duty.
5. Technical guidance to refiners of scrap metal and encouragement to them for the production of electrolytic copper.
6. Import of virgin copper free of duty.
7. Levy of heavy duties on all imports of semi-manufactures of copper and copper alloys.

Some of these seem well worthy of reconsideration ; particularly those which aim at the development of primary copper and the manufacture of copper and copper alloys.

The annual consumption of all forms of copper between 1947 and 1952 averaged 33,400 tons. Current annual requirements are estimated at 25,000 tons, comprising :

(1) Electrical cable and wire industry (tons) ...	12,000
(2) Utensils industry (tons) ...	8,000
(3) Defence, railway and other requirements (tons)	5,000

Of this the Indian output is only about 29 per cent. The difference has had to be met by imports which in the last few years have been :

	1952		1953		1954	
	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.
Copper ingots and wire bars ...	13,100	0	11,911	14	18,589	16
„ rods ...	3	4	25	1	1	8
„ scraps ...	187	6	269	18	3,535	17
„ sheets and strips ...	55	11	101	0	88	8
„ tubes and pipes ...	37	6	75	7	37	16
„ wires ...	41	3	490	0	141	5
„ other sorts* ...	31	13	55	4	4	3

* Excluding electrical wires and cables but including other electrical manufactures.

Although now, for some items, the statistical position is one of reasonable balance between supply and demand, consumption is certain to increase with further industrialization. By 1960-1, primarily as a result of the rapid expansion of the electrical industry, demand is expected to rise to about 30,000 tons per year, of which 'at least 20,000

tons would have to be of the electrolytic grade'. Attempts are being made to find substitutes for copper in several engineering industries. Experiments with aluminium—a metal which is as plentiful as copper is scarce—in light electrical industries is an example. Another is the amendment to the Indian Standard Specification for copper rods for boiler stays. It has made possible the utilization of Indian copper, which contains nickel.

Copper mining in India is likely to be for some years yet an anxious undertaking. Expansion of the industry can only come with the discovery of new deposits of copper ore. Indeed, it seems doubtful if India will ever be self-sufficient in copper.

Lead

Durability and resistance to acid are two of the notable properties of lead.

Some of the principal uses of the metal are in building construction as water supply pipes, in batteries, in sheathing electric cables and in the manufacture of accumulator plates, pipes and foils. The motor vehicle industry is one of the principal consumers of the metal in India. In the paints industry lead compounds are used as pigment; the chemical industry uses lead to prepare vats for holding acids. Lead is an essential component of solders, type metals and bearing metals. And there are innumerable lesser uses.

Generally, lead is found with zinc in mineral deposits. Occurrences of lead zinc ores have been reported from several parts of the country; chiefly Bihar, Madhya Pradesh, Rajasthan and Madras. In 1953, the Geological Survey of India started an investigation of the lead occurrences at Bhagalpur, Santhal Parganas, Monghyr, Hazaribagh, Ranchi and Singhbhum districts of Bihar with a view to determining their economic possibilities. By and large, it seems that, with the exception of those in Zawar in the Udaipur district of Rajasthan, the deposits are not large enough for economic operation. Reserves of lead-zinc ores at Zawar have recently been estimated at 10.7 million tons of different grades ranging from 3 per cent to 12.5 per cent combined metal. The total probable reserves are assessed at over 20,00,000 tons.

There was practically no production of lead in India before 1942-43, when it was started by the Metal Corporation of India Ltd., Calcutta. Till then, imports, mostly from Burma, met requirements. Supplies from Burma were cut off during World War II and the country had to depend mainly upon Australia for her requirements. The only lead deposits exploited at the moment are the Zawar and Banjari mines in Rajasthan. These are held under lease by the Metal Corporation of India. The present production of run-of-mine ore from Zawar is

about 200 tons. The ore is crushed, pulverized and passed through flotation mills to obtain lead and zinc concentrates. The lead concentrates are sent to their factory at Katrasgarh in the Jharia coal field where they are smelted. As there are no facilities in India for zinc smelting, the zinc concentrates are exported for the recovery of zinc on the understanding that 55 per cent will be returned to India as metal. The first shipment of zinc concentrates was effected on 8 June 1951.

The total production of lead ore concentrates till 1950 amounted to nearly 6,500 tons. There was also a small but intermittent production from the deposits in Jaipur; about 42 tons from 1945 to 1948 (inclusive).

During the years 1950-1 and 1951-2 production and export figures were as follows :

	1950-1 (Tons)	1951-2 (Tons)
Ore treated ...	7,231	21,266.6
Lead concentrates (production) ...	365	1,334.2
Zinc concentrates (production) ...	937	2,571.6
Zinc concentrates (shipment) ...	Nil	2,500
Virgin lead (production) ...	7,73.92	1,000

Installed capacity and production of lead in the years 1952-4 (calendar years) are shown below :

Year	Unit of accounting	Installed capacity	Production
1952	tons	6,000	1,132
1953	tons	6,000	1,694
1954	tons	6,000	1,788

There is no railway between the mines and Udaipur, a distance of about 25 miles. Ore concentrates produced by the mines, as well as all the requirements of the mines, have to be transported the whole length by lorry. This has been very trying; indeed, it has been a handicap to economic operation.

Nevertheless, as will be seen from the figures above, there has been a substantial advance in production. True, it is not yet up to full capacity. This is largely due to the paucity of dressed lead ore.

Current annual consumption of lead (all sorts) in India is assessed at 13,000 tons. The continuing gap between demand and production

has had to be bridged by imports which in the last few years have been :

Description	1952		1953		1954	
	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.
Lead ingots	3,973	12	5,075	15	11,793	15
" tubes and pipes	24	6	15	19	5	5
" scrap or secondary	—	—	3	2	32	4
" sheets and strips	170	10	138	2	63	7
" ores (including pigments)	59	19	85	13	125	17
" other sorts	22	19	140	11	20	4

The Metal Corporation of India has installed a new ore dressing plant of a capacity of 500 tons per day at the mines, which will be able to feed the smelter regularly. They have been granted a loan by the Industrial Finance Corporation to develop the deposits and arrange for stepping up the production of lead. Experiments on the 'beneficiation' of low-grade lead continue at research laboratories.

There has been rapid progress in the production of lead sheets and pipes during recent years. Subjoined is a statistical summary :

	Unit of accounting	No. of factories	Capacity	Production
1952	tons	2	2,800	44
Lead sheets	"	3	4,800	332
Lead pipes and tubes	"			
1953		2	3,830	79
Lead sheets	"	3	4,800	310
Lead pipes and tubes	"			
1954		1	1,092	98
Lead sheets	"	3	4,800	165
Lead pipes and tubes	"			

The tea industry buys large quantities of lead sheets for lining tea-chests. Latterly there has been a move—lead having been in short supply—to use aluminium for the purpose instead. Sheets up to 3 ft. in width are now being manufactured in the country. Lead pipes of Indian manufacture are extensively used in household water fittings and in the construction of chemical plant.

Set in a wider context, lead is, with the exception possibly of manganese and titanium, hardly less unimpressive than the other non-ferrous metals. A comparative statement showing the annual average production and consumption of lead during the years 1947-51 in the industrially advanced countries and India is subjoined :

(Figures in tons.)

	Average production	Average imports	Average exports	Average quantity available for consumption
U.S.A.	3,99,416	3,01,979	5,494	6,95,901
U.K.	2,840	1,82,417	10,209	1,75,048
CANADA	1,43,019	1,198	1,15,446	28,771
FRANCE	45,406	87,891	11,770	1,21,527
GERMANY	53,338	21,135	39,990	34,483
JAPAN	8,161	4,724	2,997	9,888
INDIA	588	8,640	153	9,075

(Source : *Indian Minerals*, Volume VII, No. 4.)

Nickel

Strength and resistance to heat and corrosion are the principal qualities of nickel. It is used mainly as a constituent of non-ferrous alloys (e.g. nickelled brass, bronze and silver), for chemical and engineering purposes; and less often, as the pure metal. It is used also in currency, in nickel-plating for decorative purposes, and in storage batteries.

There is no mining of nickel in India. No economically workable deposits are known. The nickel in the Singhbhum copper ores is not considered 'profitably recoverable'. There have been reports of workable deposits in Nepal. These are under investigation.

The country's requirements, about 3,000 tons per year, are imported. Canada produces the bulk of the world's supplies. Indian imports in recent years have been :

		1951	1952	1953	1954
Nickel pellets	...	92 19	257 17	104 17	266 10
" alloy ingots	...	21 13	9 8	2 10	2 3
" other sorts	...	77 0	19 10	61 9	58 3
" alloy scraps	...	988 3	155 6	1,533 13	1,679 17
" alloy sheets, etc.	...	281 0	21 7	95 18	255 13

(Source : *The Eastern Metals Review*, 7-2-1955)

Economy in the use of nickel is essential. Expert opinion has it that in certain sections of industry nickel could be replaced by 'iron chromium alloys, enamelled iron, monel metal, stainless steel, tin coating, etc.'

In January 1953, it was reported that the National Chemical Laboratory, Poona had developed a method of recovering nickel from the spent catalyst from vanaspati factories. A plant for processing nickel from coins has recently been set up in the New Mint in Calcutta.

Manganese

The metal is used mainly as an alloy element in the manufacture of steel, and to a less extent for chemical purposes and in the manufacture of ceramics, glass and dry batteries. Manganese is an important constituent of a number of useful non-ferrous alloys, e.g. manganese bronze, manganin, high- and low-expansion alloys, high-damping alloys, etc.

According to the Geological Survey of India, 'extensive workable deposits of manganese ore are distributed in parts of Bihar, in Orissa, Madhya Pradesh, Andhra, Mysore, Bombay, Madhya Bharat and Rajasthan'. 'The most important of these deposits in quality and quantity', the G.S.I. states, 'are those in Madhya Pradesh'. 'The reserves are undoubtedly considerable,' the report goes on, 'but no reliable estimates have yet been made'.

Manganese ore has been worked in India since 1892, almost the entire production being exported. In 1903, output was about 1,72,000 tons; three years later, India was the leading producer of manganese in the world. The million ton mark was exceeded in 1937; the war years, with their shipping problems, caused a decline reaching a level as low as 2,10,583 tons in 1945; but this trend was reversed in the post-war period.

Production of manganese ore in recent years has been :

Year		Tons
1947	...	4,51,304
1948	...	5,25,876
1949	...	6,45,825
1950	...	8,82,929
1951	...	12,92,375
1952	...	14,62,264
1-1-53		
to		
31-7-53	...	8,54,000 (approximate)

India is now reported to be third among producing countries, the U.S.S.R. and the Gold Coast being first and second respectively.

According to the Ministry of Labour, the average daily number of workers employed in 1951 was 55,531; 1952, 74,750 and 1953, 1,11,869.

There has been also some production in India of manganese dioxide, used chiefly in the manufacture of dry cell batteries and glass; in the latter, it is used largely as a decolourizing agent. India imports annually about 5,500 tons of high-grade manganese dioxide, of which approximately 4,000 tons are used in the dry battery industry. The National Metallurgical Laboratory is reported to have developed 'an electrolytic process for the production of pure manganese dioxide suitable for use in dry batteries'.

Technical experts consider the present methods of mining wasteful, and urge the need for improvements. Open cut methods are in vogue; and the ore is graded according to its manganese content. The first grade contains over 48 per cent manganese, the second between 45 and 48 per cent and the third grade below 45 per cent. The price the ore would fetch has been the determining factor in mining; and prices have varied according to grade, rising sharply from every unit of manganese above, say, 45 per cent. The industry has a long tradition of selecting for the market only high-grade ores; as a result, 'huge dumps' of low-grade material have accumulated in producing states; about 3.75 million tons in Madhya Pradesh, 1.2 million tons

in Andhra and about 2 lakh tons in Bihar and Orissa. As well as metallurgical coking coal, the Government of India wishes to conserve high-grade manganese ores; and as a result there has been emphasis on 'beneficiation'. In 1953, it was reported that the National Metallurgical Laboratory had evolved a method for the utilization of low-grade manganese ores in the production of ferro-manganese—an important element in the composition of industrial steel. Subsequent reports spoke of success in the extraction of manganese from rejected materials; this was a joint effort by the Indian Bureau of Mines and the National Metallurgical Laboratory.

An example of the value of research in industry was the installation in February 1954 of a heavy-media separation plant at the Dongri Buzurg manganese mine in Madhya Pradesh, designed to process dumps containing about a million tons of marketable ore. It is proposed to set up another similar plant in the Bharveli mine. Many more would be welcome, especially now that buyers' markets prevail.

In several other ways, too, assistance by the State has been forthcoming; the more important being in the supply of explosives, steel, cement and petrol; the allotment of wagons; facilities for importing mining equipment; and the services of the G.S.I. when required.

Standards have been prescribed. These should ensure a fair amount of uniformity in the selling of different qualities, the offering of the right qualities to the world market and the increasing utilization of the ore in Indian industries.

The bulk of the demand is for first-grade ore, containing 48 per cent and over of manganese, for the manufacture of ferro-manganese and manganese chemicals. On average, about 16,000 tons of ferro-manganese are being produced annually; and this is adequate to meet the current requirements of the Indian iron and steel industry, which is practically the only large-scale consumer in India.

The consumption of manganese ore by the iron and steel industry in recent years has been :

Year		Tons.
1947	...	78,106
1948	...	51,877
1949	...	79,264
1950	...	70,380
1951	...	87,007
1952	...	1,07,090
1-1-53		
to		
31-7-53	...	23,171

The dry cell battery and glass industries also absorb a small quantity (about 100 tons a year) in the form of manganese dioxide. As these industries expand, domestic consumption of manganese ore will increase; but there should be an ample surplus for export, most of which is to hard currency destinations.

In pleasant contrast to most other non-ferrous metals, manganese is an earner of valuable foreign exchange for India. Indeed, it accounts for annual earnings of about Rs 22 crores out of the total of Rs 50 crores accruing from mineral exports. Among the more important importing countries are the U.K., Canada, Sweden, Norway, Denmark, West Germany, Netherlands, Belgium, France, Spain, Italy, Austria, Yugoslavia, Japan, the U.S.A., Hong Kong and Burma. Hard currency areas have had the bulk of exports.

Not unexpectedly, the outbreak of the Korean war resulted in increased overseas demand. Indeed, it may be said that the increase in Indian exports since June 1950 has been proportionate to the fall in supplies from the U.S.S.R. to the world market. The increase was in part attributable to the American demand for stockpiling purposes. The industry has experienced difficulty in booking freight, especially to U.S. ports; and there has been an increase in freight rates to that country. In certain cases this has necessitated the diversion of exports to Europe and Japan. Latterly, there has been a progressive liberalization of Government's export policy. Licences, hitherto confined to established shippers, are now being issued also to mine-owners. Subject to a ceiling, the export of manganese dioxide/peroxide is being allowed. And from August 1954, the export duty on manganese ore has been abolished. Exports of ore in recent years have been :

1950-1	1951-2	1952-3	1953-4
(tons)	(tons)	(tons)	(tons)
8,20,780	11,24,956	14,39,678	15,67,997

Recent reports suggest the early formation of an export promotion council, whose objective is 'to put Indian manganese ore on a competitive level in the world market'.

There have been protests against the depletion of resources by increased ore exports. The development of electric ferro-manganese chemical industries has been suggested. The general interests of the country, it is pointed out, demand that the export of ferro-manganese should replace that of the raw ore as far as possible. In the U.S.A. and U.K. the bulk of Indian ore imports is used in the manufacture of ferro-manganese. If the ore were processed into ferro-manganese

before export, India's earnings, it is contended, would be 'many times more than what she obtains for the raw ore'. India today imports about 300 tons of ferro-manganese at a cost of Rs 1,200 per ton. And suitable conditions exist, runs the argument, for the development of the ferro-manganese industry. Manganese ore, coke and limestone, the principal raw materials, are available. Another fortunate circumstance is that, apart from the high-grade manganese ores found in several areas, India has vast deposits of low-grade ores, especially in Orissa and Bombay, which are very low in phosphorus, an essential requirement for high-standard ferro-manganese. And an adequate supply of cheap electric power is expected to be available soon from the 'hydel' and thermal power projects under implementation. Clearly, therefore, there is an almost unlimited field for expansion. Indeed, in many lines the possibility of a self-sufficing India should soon be realizable. The cost of production per ton of standard ferro-manganese in electric furnaces in India is estimated at Rs 600 as against imports which now cost Rs 1,200 per ton. In June 1954, it was officially reported that the Mineral Advisory Board were studying the possibility of expanding the ferro-manganese industry. Obviously, development will depend largely on the cost at which electric power can be made available and the continuance of demand abroad to absorb what this country cannot consume.

Tin

Malleability, lustre and resistance to acid are among the special qualities of tin.

The metal is used mainly in the manufacture of tinplate. Tinplate is a steel sheet coated on both sides with pure tin. Various quantities are used but the average coating is $1\frac{1}{4}$ lb. base box of tinplate. (A base box is 112 sheets 20"×40" weighing 108 lb.) Tin is used also in large quantities by the metal container industry. The electrical goods industry uses it for the manufacture of condensers. Pure tin is used in the manufacture of collapsible tubes for packing toothpaste, ointments, toilet and medicinal preparations.

There is no mining of tin in India. At any rate, there is no record of any commercial production. There have been reports of deposits in the Ranchi and Hazaribagh districts of Bihar. According to the Geological Survey of India, 'the deposits known so far have not yielded sufficiently encouraging results for entertaining any optimism about the possibility of the production of tin in this country. This is a metal for which India has apparently to depend entirely upon other countries unless some new occurrences come to light'.

Before the war, imports of tin averaged 2,500 tons a year. During the war, supplies were controlled by the International Tin Control Board. India received her quota (2,000 tons per annum) through the Ministry of Supply in the U.K. (The Tariff Board of 1946 recommended direct access to the International Tin Control Board, with a view to raising the quota to 6,000 tons.) After the war, although State trading in all other non-ferrous metals had ceased, the Government of India decided, in view of the continuing shortage of tin supplies—there was no early prospect of imports from Burma and Malaya, and attempts made to obtain a larger quota from the International Board had met with only partial success—to continue State trading in tin. Supplies for civilian consumption were released at fixed prices.

The world supply position improved towards the end of 1949, and the Government of India decided in November 1949 to give up State trading in tin also. Private imports are now allowed.

In 1950, tin ingots came mostly from Canada, Hong Kong, Malaya and Britain; tin, other sorts, from Holland and Britain; and tin-lead alloy manufactures from Britain and the U.S.A. After the outbreak of war in Korea, imports again became difficult to obtain.

Imports in recent years have been :

Description	1951 Tons Cwt.		1952 Tons Cwt.		1953 Tons Cwt.		1954 Tons Cwt.	
Tin ingots	...	2,764 8	2,093 14	•	2,751 4		4,020 8	
„ other sorts	...	17 1	4 17		1 17		2 3	
Tin-lead alloy manufactures	...	9 0	36 14		4 3		Not indicated	

(Source : *The Eastern Metals Review*)

Consumption pre-war was about 2,500 tons. During the war, tin was being rationed under the Non-Ferrous Metals Control Order and consumption kept at the pre-war level. Current requirements of tin in all forms are estimated at 4,000 tons and of tinplate, at 65,000 tons a year, and they are likely to increase in the next few years. It seems possible to curtail imports by establishing plants for smelting tin ores and concentrates and refining tinplate scrap.

Tinplate for the metal box and container trade is being produced in India by only one unit—the Tinplate Company of India Ltd.; and its annual average output is about 66,000 tons, which meets almost all of India's current demand. The company has plans to expand production to 80,000 tons a year. It draws its supplies from the Tata Iron and Steel Company.

According to available data, production and imports (in tons) in 1945 and during the years 1950 to 1954 were as follows :

Year	Production	Imports
1945	... 64,000	36,000
1950	... 68,000	19,000
1951	... 67,000	28,500
1952	... 66,886	30,500
1953	... 57,367	18,671*
1954	... 66,188	

* For 1953-4.

The kerosene trade accounts for the bulk (about 50 per cent) of Indian consumption. Towards the end of 1952, in view of the rise in the price of tin and of Tata packs (steel sheets), the Government of India, on the basis of a recommendation by the Tariff Commission, increased the retention price for 30 G. tinplate payable to the Company from Rs 726 per ton fixed for 1951 to Rs 792 per ton for 1952. From April 1954 the selling prices were reduced by about Rs 50 per ton. 'The reduction was rendered possible', the Government stated, 'by the fall in the prices of tin during recent months'. World tinplate production in 1953 reached a new peak of 57,90,000 tons as compared with 54,27,000 tons in 1952 and the previous peak : 56,79,000 tons in 1951.

Exports of tinplate are not easy to arrange. No extensive overseas trade is expected. Against the electrically processed tinplates the Indian hot-dipped varieties, in spite of their suitability for some special uses, have little chance in markets abroad.

Zinc

Almost as important as, and occurring invariably in close proximity to, lead is zinc, of which there is yet no production in India. The Panel on Non-Ferrous Metals recommended investigation of deposits in Zawar, now under lease to the Metal Corporation of India, and suggested that steps should be taken to start smelting plants in Zawar and Kashmir. It seems that the possibilities of zinc production in India depend mainly on investigations in Zawar, Kashmir and Nepal. No economically workable deposits have so far been found.

The industrial uses of zinc, or spelter (as it is known commercially), have greatly increased in recent years. The country's annual requirements are assessed at 30,000 tons, all of which is imported. A few figures of imports in the last few years are given below :

Description	1951		1952		1953		1954	
	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.
Zinc virgin	17,574	3	23,720	14	22,503	13	36,043	8
.. dross or hard spelter	142	7	172	10	186	2	451	16

Description	1951		1952		1953		1954	
	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.
Zinc remelted . . .	100	0	—	—	—	—	—	—
„ sheets and strips	2,509	6	1,595	18	3,475	1	3,087	5
„ other sorts . . .	197	1	153	7	146	12	372	8

Virgin zinc has come mostly from Rhodesia, Australia, the U.S.A., Belgium, Canada, Holland and Italy; dross from Holland, Sweden, Canada, Denmark and Britain; sheets and other sorts from the U.S.A., Britain and Australia. There is some production in the field of semi-manufactures. The situation in the last few years is summarized below :

	1952	1953	1954
Zinc sheets/strips			
No. of units . . .	1	3	3
Installed capacity (tons) . . .	300	4,410	4,410
Production (tons) . . .	19	77.45	45.65

Among schemes approved by the Government during 1954 were two for zinc strips which will increase capacity by about 166.6 tons per month.

Imports of zinc are under Open General Licence.

The Metal Corporation of India are allowed to export zinc concentrates (production of ore per day ranges between 150 to 180 tons) as there are no refining facilities in the country. About 4,100 tons of zinc concentrates were exported in 1953.

In October 1951, the Government of India appointed a committee to examine and recommend schemes for the establishment of a zinc (spelter) industry in India. Its functions chiefly were : to recommend steps for assessing resources of zinc ores at Zawar (Rajasthan) and other places in India; to advise on location for one or more zinc smelting plants and the methods to be adopted; to recommend the agency to be placed in charge of smelting, and to report on the advisability of entrusting this to the Metal Corporation of India, keeping technical and financial aspects and the existing legal commitments in view. In June 1953, it was learnt that the committee had reported that the Zawar (Udaipur) lead, zinc and silver mine was the only important source of zinc ore in India containing large reserves of workable ore on which, when fully developed, India could depend both in peace and in war. The committee, it was added, had recommended the setting up of a new organization to develop the mines and undertake intensive and extensive prospecting so as to produce 1,000 tons of ore a day, and to expand the smelting plant to treat the quantity. Another important recommendation was collaboration with a foreign firm having considerable experience in the line.

Apart from not being a producer, India, as will be seen from the table below, is relatively only a small consumer. Average production and consumption figures of zinc during the years 1947-51 in the industrially advanced countries vis-à-vis India are shown below :

(Figures in tons)				
	Average production	Average imports	Average exports	Average quantity available for consumption
U.S.A. ...	7,37,505	3,08,368	82,475	9,63,398
U.K. ...	68,883	3,25,435	20,805	3,73,513
CANADA ...	1,79,365	12,629	2,24,399	—
FRANCE ...	59,749	1,51,369	7,019	2,04,099
GERMANY ...	81,183	10,054	44,744	46,493
JAPAN ...	34,186	10,078	8,879	35,385
INDIA ...	—	30,893	—	30,893

General Developments

Although appreciable, progress has been irregular in pace, for there were several factors over which neither the Government nor the industry could have control. Finance, and imports of ore, machinery and equipment are instances. The direction, however, is clear. Development has been generally along the following lines :

- (a) Detailed prospecting to determine accurately the extent of known deposits and discovery of new and workable ores.
- (b) Expansion, where possible and desirable, of existing capacity.
- (c) Re-organization of the industry.
- (d) Establishment of field stations in the mining areas for ore-dressing, refining and 'beneficiation' of sub-standard ores.
- (e) Setting up of plant to process ores to semi-manufactured state before export.

Aluminium and manganese ore supplies seem to be well assured ; others are either patchy in distribution or poor in extent. For industry in its present dimensions, some reserves are perhaps adequate. Copper is an instance. But considered in relation to India's total area and population, reserves are small.

Knowledge of the metallic mineral resources of India is very far from complete. Energy should hence be directed to the discovery of new and workable deposits. The physical effort of making a detailed survey of a vast area is naturally very great. The First Five-Year Plan included a provision of Rs 67 lakhs for the further expansion of the Geological Survey of India and Rs 39.2 lakhs for the five-year expansion programme of the Indian Bureau of Mines. Difficulties in recruiting personnel and the purchase of equipment have hampered progress, particularly in the case of systematic mapping,

inspection of mines, prospecting and mineral beneficiation, where, of the investigations undertaken, less than a third could be completed.

Yet a good beginning has been made ; and ore has been encountered in several new areas. It is too early to say whether or not there is enough to make mining profitable, but preliminary results in some cases seem encouraging. Further testing is being done and will continue for some time to ascertain the strength of the new finds. Fuller information should be available within the next few years to show clearly whether or not these new sources are sufficiently large to warrant the establishment of plant. The Central Mineral Advisory Board has recommended that the Government of India 'should itself undertake detailed prospecting to determine accurately the extent of the deposits'. The proposal is now under consideration by the G.S.I. and the Indian Bureau of Mines.

The Geological Survey of India has been striving to determine the extent of known reserves and discover new ones.

Although little is known yet of the results of recent attempts, it is good to know that the country will not remain ignorant of its resources for want of effort. But discovery and development will inevitably take time, and there has been undue dependence on the Government for prospecting. The late Dr. Syama Prasad Mookerjee's suggestion that industry should set apart a portion of its profits for prospecting is sound. Joint operations by the State and industry are well worth an attempt.

Non-ferrous ores have been known to exist, and have been worked, in India from ancient times. In its present form, however, development is essentially the result of war. The peril which a shortage of metal posed gave an impetus to indigenous effort. Plant was installed to meet various and varying needs. The crisis was overcome. Much of the wartime expansion continued after the war. There were 133 registered factories in existence for aluminium, brass and copper in 1946. By 1947 the number had increased to 158. Yet the industry has not been able to overtake needs. With the exception of some aluminium and a little copper, industrial non-ferrous metals are either not produced in India or their production forms only a very small fraction of requirements. In the field of semi-manufacture and fabrication, however, progress has been significant.

Local Production

Indigenous production capacity for many items has substantially increased. Sheet mills are now capable of meeting all the brass and copper requirements of the country. An extrusion press has come into existence. With the exception of paper-insulated cables, almost all types of cables are being produced in India in adequate quanti-

ties. The entire requirements of lead foil for the tea industry are being met by the foil manufacturing industry. And there has been improvement in the quality of lead pipes and tubes produced in India.

Hardly less heartening has been progress in the alloys sector :

	1952	1953	1954
Non-ferrous alloys			
(such as anti-friction bearing metal, bell metal, white metal, bronze, gun metal, solder, type metal, etc.)			
Number of units	13	15	15
Installed capacity (tons)	68,000	69,000	69,000
Production (tons)	7,650	6,104.80	10,952.22

The expansion schemes seem soundly conceived. They stem from the idea that the demand for metals will go on rising for some years yet ; and partly from the fear that, if the present difficulties persist, foreign shipments of metal to India might increase. The cost of the schemes has been worked out only in broad terms (e.g. the expansion programme of the aluminium industry over the next few years is estimated to cost Rs 9 crores) which must be adjusted as the schemes progress, and no extravagant claims for large quantities of metal have been lodged. Flexibility is an essential part of the conception.

For ingot manufacture from available indigenous ore, there are three well established companies in India. On the semi-manufacturing and fabrication side channels are not so well defined. A large number of companies is engaged in manufacturing and distributing a variety of products. Of organizations representing the industry, the Indian Non-Ferrous Metal Manufacturers Association seems the most important. There have been complaints that the industry has no clear statistical background, and investigations indicate that the complaints are largely justified. The collection of non-ferrous metal statistics is a task to which the Association could with advantage address itself. There are other organizations representing sections of the trade, e.g. the Metal Ware Manufacturers Association. A Metal Arbitration Board for the purpose of adjudicating on and effecting settlement in disputes arising in the metal trade, both in regard to foreign shipments arriving in the country and materials transacted within India, has been formed.

The expansion of the industry upon the scale contemplated will involve a demand for materials which can only be met by careful conservation of existing resources. Only latterly has there been an

attempt to husband supplies, and to upgrade the ore and utilize it for the most suitable purposes. Research has shown that the metal content, though obviously important, is not the only consideration. Beneficiation has been introduced, and attention has more recently been given to the possibility of establishing plant for the purpose. The conclusions reached at the second meeting of the Central Mineral Advisory Board at Ranchi on 3 June 1954 reflect the trend of current thinking on the subject. The Board accepted in principle the need for the establishment of beneficiation plants and recommended that the big mine owners should be encouraged to set up such plants themselves. Smaller mine owners could, it was thought, form a co-operative organization and set up a joint plant to meet their requirements; otherwise the Central and State Governments might set up customs mills, on the lines of the American customs mills, for the benefit of small owners. The State Governments interested in the prospect were asked to submit proposals to the Centre for consideration.

The home processing of ore into semi-manufactured state before export is to be attempted with manganese. Among the advantages expected to accrue are the new employment created for local technical talent and labour, the higher value derivable from manufacture, and the saving of foreign exchange which would otherwise have to be spent in the importation of the manufactured product.

State Assistance

Forms of State assistance chiefly required, a few of them in some measure already applied, are as follows :

1. Fixing the rate of royalty at a reasonably low level ;
2. Uniformity in the administration of the mining rules and regulations ;
3. Reduction in freight rates ;
4. Refund of duty on imported machinery ;
5. Introduction of a planned system of technical training fully co-ordinated to the requirements of the industry ;
6. Reduction in rates of taxation ;
7. Loans for expansion programmes ;
8. Tariff protection ;
9. Grant of import licences for scarce metals, machinery and equipment ;
10. Liberalization of the export policy for such goods as are surplus to home requirements ; and
11. Rationalization of the home market.

According to the Industrial Policy Resolution (6 April 1948) of the Government of India, the non-ferrous metals industry is one 'the planning and regulation of which by the Central Government is necessary in the national interest'.

Reduction of the rates of royalty to reasonably low levels is required to encourage the industry to work the minerals properly.

Wide local variations in the administration of the mining rules and regulations continue to cause much avoidable annoyance. Uniformity is overdue.

Location has depended upon a variety of factors, principally, proximity to ore and coal and access to markets, leading to reduced transport charges. (With the discovery of new deposits, some decentralization may be expected; a result not unwelcome, for it may mean wider distribution of opportunities for employment.) Even so, the application of the general rate to this industry, whose raw materials and finished products are both bulky and heavy, has told heavily on the cost of production. A possible revision of the freight structure to suit the industry seems well worth consideration.

The Tariff Board of 1948 recommended the refund of duty (then 10 per cent) on machinery to the non-ferrous metal industries with retrospective effect from 3 November 1945, when the case was first referred to Government. Relief has come in the form of a general reduction of duty to 5 per cent on all machinery. The need for assistance was recognized, if somewhat negatively, in the Report of the Estimates Committee of the Commerce Ministry.

The Committee recommended that 'except for essential requirements of machinery and raw materials for industries, imports should be curtailed to the minimum'. Required machinery is not easily available, and when available it is expensive. Heavy capital outlay is not needed.

Accepting the recommendations of the Industrial Development Committee, the Government of India constituted an Industrial Panel for Non-Ferrous Metals. The Panel was to advise the Government on measures to ensure the full utilization of industrial capacity and requirements of raw materials and equipment.

More is required than good machinery and the best materials; imperfect handling will spoil both. It is the skill of the workers that carries the promise to fruition. Labour, if it can secure employment in easily accessible areas, will hardly be willing, unless the inducements are adequate, to migrate to remote areas. The industry is one in which technical knowledge is, and can be, fruitfully employed. The creation of more training centres at university level for geologists, geophysicists, metallurgists, mining engineers and drillers is under study.

Without the experience of foreign manufacturers, development would have been difficult ; and it seems that foreign technical assistance is still, and will be for some years, a necessity. The industry has complained of labour indiscipline. There have been in recent years—1949 in particular—strikes in several factories.

In view of the limited and unreplenishable nature of the reserves and the risk of unpredictable losses inherent in all mining operations, revision of the whole tax structure seems justified. The cost of production has risen to a height hardly thought of a few years ago, and it is apparent that it cannot be reduced without an increase in the quantum of production, which in its turn is dependent on a large market. In a survey of this nature it is hardly possible to discuss the economics of production. The task had better be left to the Tariff Boards convened from time to time. Lower rates of tax may well lead to the working of marginal reserves, more extensive exploration, new sources of revenue to the State, and new avenues of employment and trade. In its appeal for taxation relief, the industry has had the support of the Central Mineral Advisory Board. The question is under consideration by the Taxation Inquiry Commission.

There exists no reservoir of liquid financial resources from which large sums could be drawn to provide capital for several new fully equipped factories. Post-war inflation and a series of disincentives to investment have crippled the normal sources. The industry has had to rely for finance largely on its profits, which latterly have been dwindling. The ramifications of the expansion schemes are vast. Loans, to be effective, would need to be liberally conceived ; for instance, freedom from capital repayments for a few years would be most welcome, as would private investments for a few years. Private investment requires security if it is to be attracted ; but in return, the obligation to plough back a fair proportion of the profits earned must be accepted. Capital need not be confined to India. Given good faith and political tranquillity, the market for capital is the world itself.

The Tariff Commission has taken cautiously progressive decisions on the development of the industry in its various branches. Virtually, the industry has grown up under the shelter of tariff protection.

Imports

Before the war, India experienced no difficulty in obtaining supplies of non-ferrous metals from abroad so long as importers were willing to pay the ruling market prices. Indeed, any import difficulties that arose were of India's own making, e.g. import duties.

In 1949, the U.S.A. supplied 35 per cent of India's metal imports. In 1950, although the percentage had fallen to 20.3, the

U.S.A. continued to be the main supplier of non-ferrous metals. Malaya supplied 13.8 per cent of India's imports in 1950 (less than in 1949) while Britain, which in 1949 had supplied 13.5 per cent, in 1950 supplied only 9 per cent. There was an increase of imports from Australia, Rhodesia and Japan during 1950, the largest being from Australia, which in 1950 supplied 9 per cent of India's metal imports against 1 per cent in 1949.

About 70-80 per cent of consumption is met from imports. In 1950, imports cost India about Rs 23.7 crores; in 1951, about Rs 18.89 crores and in 1952, about Rs 14.00 crores.

Licensing policy for imports in recent years has been much criticized. There have been, it is pointed out, delays in the issue of licences, resulting often either in the withdrawal of offers or an increase of prices. The placing of non-ferrous metals under Open General Licence was, it appears, not early enough to be of full advantage to the industry. Licences issued, it is added, were for small quantities; for material unsuited to industrial requirements; and for imports of manufactured and semi-manufactured items for which there was enough capacity in the country. Import licences are now issued by the Chief Controller of Imports. The industry would prefer licensing work to be handed back to the Development Officer (Metals). As difficulties have been experienced in clearing goods from the Customs, there has been a demand also for rationalizing and re-classifying non-ferrous metal items in the Indian Customs Tariff.

For some time, India was at the mercy of foreign producers for obtaining her ever-increasing requirements of non-ferrous metal and metal items. Increasing difficulties were experienced in their importation. These may be attributed in the main to the following factors: (a) The increase in world demand for metals was larger than the expansion of output from mines. (b) Producing countries were anxious to sell to the dollar area to earn valuable foreign exchange. (c) Supplies from the sterling area had mostly been taken by Britain. (d) Restrictions or embargo on exports by many producing countries and stockpiling by the Governments of several countries. (e) Private stockpiling. (f) Paucity of shipping space.

World production capacity had fallen far in arrears. This, perhaps, was statistically provable, but was generally less realized than it should have been. Most of the metal from Western Europe was being exported to the U.S.A. under the Mutual Aid Programme. Western Europe's anxiety to earn dollars is understandable—as indeed is that of many other areas. Britain has large investments in metals in many sterling countries. Priority for Britain in exports was inevitable in the circumstances. And many producing countries either banned or res-

stricted exports with a view to stockpiling for defence. There was a mobilization of resources on all fronts.

The U.S.A. transformed itself from a net exporter to a net importer. Reports indicated that she was engaged in accumulating stocks of over 70 strategic materials, of which metals and minerals formed an important part. In aggravation, there was stockpiling by some industrialists abroad, who laid in stocks, anticipating a possible shortage and higher prices. Demand had no relation to consumption. All this made a world shortage of what might otherwise have been a reasonably comfortable supply position.

Non-ferrous metals are liable to sudden changes of fortune in the world market. It is conceivable, though by no means certain, that a period of stringency may develop into one of actual shortage; and prices may rise because supplies are not broad enough to give a full choice. The issue of import licenses in time, and for adequate quantities, is one way of guarding against such possible dangers. Combined with more vigorous attempts at negotiating trade pacts with countries producing non-ferrous metals, it should yield substantial results. And the using of surplus commodities as a bargaining counter for scarce ones (e.g. bauxite for copper) may well be tried. It is no violation of commercial ethics.

Exports of manufactures have been relatively small; of these, utensils have formed the bulk. Large exports do not seem possible for many years, for the essential conditions do not exist. There is scarcely an industry more liable to, and affected by, competition than that of non-ferrous metals, for the products are universal needs and produced on a very large scale. Abroad, manufacturers are assisted by works whose technical equipment is of the best and whose capital charges are, as a result, low. Apart from modernization of machinery, in some cases (e.g. manganese), capacity will have to be increased if India is to secure its share of a widening market. Export is being encouraged as part of national policy; but piecemeal announcements of permission have hampered expansion. Export promotion, to be effective, requires that announcements of eligibility and quantity should be well in advance of the relevant period.

The Government of India appointed a Committee in October 1949 to investigate the possibilities of State trading. The Committee recommended that 'the desirability of reintroducing State trading in non-ferrous metals should be examined by a State Trading Corporation', which they proposed should be established. For State trading the following advantages have been claimed. It will facilitate the regulation of internal prices and equitable distribution of goods in scarce supply and secure a more effective enforcement of grading and standardiza-

tion in commodities. Against this, there has to be weighed the danger of costly blunders in bulk buying and selling by an untrained bureaucracy.

Conservation and Substitutes

Apart from the fact that metals—ferrous or non-ferrous—are a wasting asset and hence have to be carefully husbanded, reports emphasize the need for conservation. Among possibilities, the more important are : (a) greatest possible recovery from scrap, (b) substitution for scarce metals of metals comparatively easily available, (c) a ban on exports, (d) stockpiling by the Government and (e) restrictions on consumption.

The reclamation and utilization of scrap relieve pressure on the primary metal, and, if only for this reason, should find a prominent place in any scheme of metal conservation. The production of virgin metals from indigenous scrap has been developed in all countries deficient in metals. In India, although there are a large number of companies engaged in the task, there is no well organized scrap utilization trade. The setting up of refineries on a regional basis seems a possibility well worth exploring. The recovery and refining of scrap helped to overcome the reduction of imports during the war. Although imports of scrap are now mostly under OGL and are free of duty, not enough is coming into the country. The scrap refinery section of the industry has again a valuable role to play : and, for this to be satisfactorily accomplished, it needs to be properly organized and developed.

Research to discover suitable substitutes for scarce metals in at least the more important of their uses is a line in which much may be achieved. The use of aluminium in place of copper for electrical needs is a good example. 'The present price structure of metals is such that aluminium can economically replace copper for most electrical purposes,' said Sir Jehangir Ghandy in November 1949. Dr. Bhatnagar and Dr. Mahant recommended the use of aluminium cables as carriers for electricity in place of copper cables. 'So far as the economics are concerned,' they said, 'a close examination will reveal that the use of aluminium will not involve any extra costs, the price of copper and aluminium being almost the same. Even if, compared to copper, thicker wire has to be employed on account of the lower conductivity of aluminium, the much lower density of aluminium will more than offset the disadvantages.'

Notice must be taken of stockpiling abroad. Measures in the U.S.A. have already been touched upon. Britain, through bulk-buying, has secured supplies of aluminium a long time ahead and has long-term arrangements or understandings with Commonwealth pro-

ducers which assure her a large part of the nickel she needs. The Government of India belatedly set up a special committee to investigate the country's requirements in scarce commodities and plan a stockpiling programme.

Improvidence continues to characterize both production and consumption. Expert opinion has it that 'a number of mines are being run systematically, but the greater majority of the mining operations are inefficient and often wasteful'. (Dr. M. S. Krishnan) Selective mining of high-grade ore persists; and bauxite and manganese are not yet being worked on a scale commensurate with the size and richness of the deposits. Neither scrap reclamation and recovery of secondary metals nor the substitution of scarce metals by those relatively more abundant or those easily procurable has made much headway. Statutorily perhaps, something could be done in both directions; but it seems preferable to begin by impressing upon producers that 'mineral deposits will have to be regarded as national wealth, the wastage of which is indefensible'.

Domestic demand, although increasing, is yet relatively so small, irregular and diverse that large-scale production is uneconomic. In some cases purchasing power is not available to make demand effective; and purchasing power can only be built up by the development of resources, the surest way to which will be an increase in investment.

A considerable proportion of total supplies—of brass and aluminium in particular—is used in the manufacture of utensils. If this extravagance persists, it may cause confusion, nullifying even the benefits which may accrue from a possible realignment of prices.

Circumstances point to one conclusion: the need for distributional controls in India. Tests of essentiality are tacit in any scheme of planned distribution. A way has to be found to regulate demand without interfering unduly with the market mechanism. The example of Britain seems well worthy of emulation. 'It can be tackled in one of two ways—by an elaborate system of Government allocation and control, or by relying on industry to do the job itself under general guidance. We have chosen the latter way, not only because industry prefers it but because we prefer it too,' declared Mr. Strauss, British Minister of Supply, on 3 March 1951.

Public indents for goods have been on the decline. Some of the more important consumers, such as the railways, are manufacturing their own alloy requirements. Hardly less disconcerting have been disposals as scrap from Government surplus stock of finished and semi-finished items at prices far lower than the prevailing market rate. In aggravation, competition from Government units (e.g. ordnance factories, Hindustan Aircraft) for Government contracts has been keen. While increased buying from Government factories might be, the industry

points out, of immediate advantage to the State, it would certainly stifle private enterprise which, when required to supply State requirements in an emergency—the State units could not obviously be depended upon as a permanent source of supply—might be found unequal to the task. The possibly lower prices quoted are attributed to the absence of any proper system of commercial cost-accounting in State factories. Allowing capacity in either sector to lie idle is hardly economic. An early equitable division of the market between the two seems essential.

The indications are that Government will not allow surplus capacity in the Hindustan Aircraft Factory to be idle and that, while the railways will continue to manufacture their own requirements of alloys, they will not compete in the open market. In regard to releases from Government stocks, a section of the industry has suggested that 'if the protection given to the semi-manufacturing industries is not to be nullified, items released should be mutilated or broken up'. A more wasteful procedure is hardly conceivable!

The market for non-ferrous metals in India is dependent on the purchasing power of the people—which has never been high—to a greater extent than markets for many other commodities. The absence of a futures market, which could provide cover against price fluctuations, may have hindered the creation of reserves. Over prices, the U.S.A., as the largest producer and consumer of non-ferrous metals, has the greatest influence. After World War II prices rose, and became very high in 1949, falling later in the year. After June 1950, when the Korean War broke out, there was again a rise. Rupee devaluation in September 1949 had already resulted in an increase in import prices as most of the virgin metals had to be imported from the dollar area. And this increase had repercussions on industries which are large users of dollar raw materials. A rise in the price of fabricated products was in the circumstances inevitable. In some cases, devaluation very nearly offset tariff protection. The Government has made it clear that it does not contemplate revaluation of the rupee.

Hard on the heels of devaluation came stockpiling. There are now indications that the U.S. Government has at last realized that, even in terms of defence, indiscriminate buying for the stockpile, regardless of prices, can have very damaging effects. Hence the optimistic and rather naive suggestion from certain quarters that deflation is certain and that some benefit might accrue from deferment of purchasing. If peace, even of the present unconvincing character, could be postulated indefinitely, the matter would reduce itself to a comparatively simple proposition. All that can be said with safety is that the determining factor in prices will continue for some time to be the degree of international tension. Latterly, there has been a

steady decline in prices. Metal prices in India are governed by replacement costs in the world market.

Prospects

Where stands the non-ferrous metals industry in this context?

In primary production, progress has been satisfactory; and in semi-manufacture and fabrication, it has been substantial. An intensive and extensive search is being made for new deposits. The industry has had State assistance in ample measure. And there have been assurances for the future. To revert—inevitably—to the problem of shortages, there is increasing awareness in Government circles of the strategic and economic issues at stake. Imports of most of the non-ferrous metals are now under Open General Licence. A start has been made in stockpiling. Whether these presage a new policy is difficult to say. But that they will in time mitigate the scarcity seems certain. Prospects will depend largely upon the extent to which the State and the industry can get together to overcome what is obviously a difficult situation. Together, they could strive for maximum production; maximum imports from abroad; maximum recovery from scrap and the rationalization of consumption, which by and large constitute, in present circumstances, perhaps the best basis for joint effort.

The deductions to be drawn from the above considerations are clear. How the required results are to be pursued is a more difficult question. That the industry is faced with big problems is obvious, but the fundamental physical conditions which governed its growth over a long series of years remain substantially unaffected. The solution of those problems is not yet in sight. It is perhaps implicit in the general thesis of the Five-Year Plans that agricultural advance is only a prelude to industrial development.

THE AUTOMOBILE INDUSTRY

'OURS is a tin-can civilization running on rubber wheels,' said Henry Ford about 40 years ago. In retrospect, the remark seems a delightful hyphen between analysis and prophecy. Much has happened since—not to falsify but to justify what he said. From the old ramshackle 'tin can', in which everything made a noise except the horn, to the high-horse-powered limousine, fitted with electrically-operated doors, radio and cocktail cabinets, is a far cry.

Among the much misunderstood industries in this country the automobile industry holds a high place. Were the ownership and use of a motor-car merely held to mark the difference between households which are 'comfortably off' and those below that level, there would be little cause for complaint. Indeed, statistical investigation might confirm the correctness of such a belief. But the car has unaccountably created a new sense of values.

Commensurate with its horse-power, it is supposed to confer upon its owner a certain distinction—to raise his status in the social hierarchy. It is looked upon as a luxury, an article of fashion, the privilege of the upper middle class and the plaything of the rich. An examination of the factual basis for such beliefs will lead one into the mazes of mass psychology from which retreat will be difficult; and the findings may be inconclusive. What is definite, however, is that such beliefs have overshadowed other implications. In fact, the automobile industry has had to vindicate itself and seek support both from the State and the people for its development.

The interdependence between industrial development and the availability of efficient motor transport should be too obvious to need emphasis. Industrial raw materials are locked up in inaccessible parts of the country, and it is largely motor transport, by its flexibility and speed, that can make them available for conversion into finished goods; and finished goods are so much waste matter unless they can be moved from the factories to the homes that use them. Similarly, agricultural produce is valueless unless it can be moved from the fields in which it is grown to the villages and towns where it is distributed to those who need it.

Further, the automobile industry is basic to the manufacture of tractors and other agricultural power units. There is also in the automobile industry the probability of increased and intelligent employment. Apart from absorbing an appreciable amount of unemployed

labour in its own factories, the automobile industry would, by fostering the growth of many such related industries as rubber, leather, upholstery, aluminium, glass, paint and batteries, open up wider fields for employment.

The last two wars have proved only too clearly that motor transport is essential for defence. Not only did the automobile industry in many countries supply the necessary transport vehicles for military purposes, but it undertook the manufacture of engines, aircraft parts and certain vital requirements of munitions. Dependence on imports of vehicles would have been dangerous in such an emergency and might well have seriously compromised the defence potential of the country.

World War II left considerable arrears of replacement. The growth of population, increased use of staff cars by commercial concerns and Civil Government departments, improvement in the standard of living, growth of the travel habit, re-location of industrial and residential centres, increase in the new uses for vehicles (e.g. laundry vans, milk vans, mobile cinemas and canteens), the development of new roads, better road-rail co-ordination and the consequent diversion of short-haul goods from the railways to road transport, and increased haulage as a result of increased industrial activity are some of the factors that will, by and large, shape the character of the market.

Increasing revenues to the State, which incidentally has been in the throes of deficit financing for some years, is another interesting possibility. Britain's most profitable industry today is the manufacture of automobiles. The saving in valuable foreign exchange that it would effect here is immense. And the advantages are not all economic and military. As a means of furthering national integration the value of the industry is considerable. Increasing facilities for communications between different parts of the country will mean increasing opportunities for cultural contacts between communities. The need for such opportunities in a country like India can hardly be overemphasized.

History of the Industry

It seems that the first car was imported into India in 1900. Mr. George Radcliffe Genge, Editor of *Motoring In India*, writing in the *Capital Jubilee Number* (3 November 1938) stated: 'At the very dawn of the century, Mr. M. A. H. Payne of the well-known Bombay firm of importers brought out a 9 h.p. German car called the Beaufort. This was a vehicle of advanced design: it had a steering wheel instead of a tiller-bar. . . . By 1903 India had awakened to some of the possibilities of the motor-car and the first reliability trial from Bombay to Delhi was held. The trial was won by a 4 h.p. Wolseley

which ran without a hitch the whole distance but which—or so Mr. Payne says—did not win the first prize because its bodywork was not so pleasing as that of a rival car!

The automobile industry in India is of comparatively recent origin. To write of the birth of the industry might be technically incorrect, for—pursuing the metaphor—there was no period of gestation. Intrinsically it has been, and will continue to be for a few years yet, a process of transplantation; and the products of the plant still retain much of their exotic charm.

Before World War II only two companies in India, General Motors Ltd. and Ford Motors Ltd., were engaged in the assembly of motor-cars and trucks. Now there are twelve.

Car registrations in India during the years immediately before the war showed only a slow rate of increase, the number being concentrated in the European community and a small section of the Indian population. The assembling capacity for cars and trucks before World War II was less than 30,000 annually. Now it has risen to about 80,000. The paid-up capital of all the plants now in operation is about Rs. 13 crores.

During the war India developed its engineering industry and bodies were made for military vehicles; and during the last few years there has been considerable expansion of the Indian automobile industry.

The progress made is the more significant because there have been few more telling indications of the adaptability of India's economy than the performance of this industry. In a sense, it has been the touchstone of India's industrial progress.

Yet, compared with the U.S.A. and Britain, the automobile industry in India is still in its infancy. The figures are self-explanatory: there is one motor vehicle for every 4 persons in the U.S.A.; one for 8 persons in Canada; one for 18 persons in Britain; one for 25 persons in France; while India has only one for every 1,500 persons. Even a small country like New Zealand has more motor vehicles than India. In the U.S.A. every seventh worker is directly or indirectly working for the automobile industry or business—a number which, when put together, is much bigger than the total industrial population of India.

Raw Materials

Raw materials required for the industry, apart from specialized textiles, leather, cellulose, etc., are pig-iron (foundry, basic and malleable), steel (plates, bars, billets, tubing, strips, wire rod, and wire spring) and non-ferrous materials and chemicals (electrolytic copper, aluminium, sulphuric acid, black carbon, paint and sulphur).

The industry specifies 118 different types of steel and 92 different types of castings. The responsibility that such a wide range of requirements places upon related industries to supply is immense.

Iron and steel are available in India, and the fact that Tatas supplied steel of several difficult specifications to Government during the war is enough evidence that the capacity to manufacture the types of steel necessary for automobile components also exists.

There are also now a number of other companies, e.g. Bharatia Electric Works, equipped with electric furnaces capable of manufacturing steel to specifications required by the automobile industry. Yet the supply of these raw materials for the industry, lamentably enough, is still largely from imports. This can be ascribed perhaps to the fact that the price of imported iron and steel is a relatively small factor in the cost of production, and to lack of liaison between automobile companies and the iron and steel companies.

That such continued dependence upon imports, however small and inexpensive, should end, few will dispute. Small as the requirements of each automobile company for iron and steel are, separate indents are hardly likely to encourage production of the material. Bulking of requirements and joint procurement by the automobile industry seems to be the only rational course, but there is little evidence of effort in this direction.

An examination of the question by an expert body with a view to augmenting the present output or creating sources of supply seems essential. In some countries where the availability of raw material for the automobile industry is uncertain, small or dwindling, control over distribution of the raw material among automobile manufacturers has been taken over by the State, and automobile companies are being allotted quotas with specific reference to their production performance and possibilities.

Components

The manufacture of automobile components within the country is in the nature of a challenge and an opportunity to India.

Automobile components can be classified as :

- (a) Engine components,
- (b) Electrical components,
- (c) Transmission and suspension components,
- (d) Frame and body components, and
- (e) Tools.

The automobile industry uses more machine tools than any other

industry. There are about 140 factories in India engaged in the manufacture of motor vehicle components. The situation in this country in regard to their manufacture, although it varies with each type of component, can be generally summarized as follows :

1. In respect of some components, capacity for manufacture exists in India, but quality has to be tested and improved, and quantity has to be increased.

2. In respect of other components, capacity for manufacture has to be created by (a) the import and installation of new machines, (b) furnishing the indigenous engineering industry with correct specifications, and (c) linking up with foreign firms for technical guidance, as little headway has been made in light precision engineering in India.

3. In respect of certain other components, the cost of indigenous production is high, and effective substitutes have to be found.

The report of the committee appointed by the Government in May 1949 to go into the question of the manufacture of components is well worth studying. With the exception of the deliberations of the expert committee appointed in June 1949, the report is the only clue to Governmental policy on this question.

The committee was of the opinion :

(a) That to improve the quality of components which have not reached the standard required by the automobile industry, Defence Services facilities for testing should be made available, if desired, to the industry at costs to be mutually agreed upon. (The Defence Department representative who attended the meeting of the committee agreed to have performance tests carried out by the Defence Services within a short time of the receipt of the components.)

(b) That the engineering industry in India should be invited to take up the manufacture of the parts and components, if necessary, by making mutually advantageous arrangements with foreign firms of repute who are in possession of the technical 'know-how' and who also possess the patent rights.

(c) That it might be necessary to obtain Government assistance in respect of patent rights, technical 'know-how', etc., for the establishment in India of factories for the manufacture of certain important parts of automobile machinery, and that the public should be invited to set up such factories.

(d) That the number of different sizes and types of cars and trucks should be drastically reduced.

(e) That it was not necessary to set up any State-owned factory to manufacture automobile components but it was desirable that assemblers

and component manufacturers should come together at least once in three months at meetings convened by the Government so that spare capacity available for the manufacture of components might be brought to the notice of assemblers.

Reduction of the import duty on machine parts and capital plant from 10 per cent to 5 per cent was a step in the right direction. It needs to be followed up, as recommended by the committee (1949), by allowing imports of raw materials which cannot be obtained in India, duty free to manufacturers of components. Efforts are being made to build up complementary industries relating to the manufacture of various automobile components. The statement below summarizes the situation in 1953 and 1954 :

ANCILLARY INDUSTRIES

Name of the Industry	No. of Units	1953 Installed Capacity Nos.	Actual Production	No. of Units	1954 Installed Capacity Nos.	Actual Production
1. Cylinder Liners	1	1,20,000 ^A	17,318	1	1,20,000 ^A	23,856
2. Piston Rings	1	12,00,000 ^A	13,76,339	1	12,00,000 ^A	15,75,668
3. Pistons	1	3,00,000 ^A	65,497	1	3,00,000 ^A	1,14,223
4. Sparking Plugs	1	3,00,000	24,108	1	3,00,000	1,12,593

^A Capacity assessed by the Tariff Commission.

N.B. (a) Hindustan Motors Ltd., Calcutta are also producing pistons for their own vehicles.

(b) Many small firms are also producing cylinder liners.

Recent reports suggest that by the end of 1954 the use of Indian-made components, in terms of value, had reached 60 per cent in one model, 26 in another, 20.34 in a third and 14.75 per cent in a fourth.

About 17 firms are now said to be engaged in manufacture. With some of these, foreign firms are associated. The capital invested is assessed at Rs 1.2 crores, of which Rs 6.12 lakhs is reported to be foreign.

Standardization

The long-term policy of the British automobile industry centres on the standardization of components with a view to simplifying mass production, in respect of which great progress has already been made. Economic forces drove the manufacturers to cut their costs by making the maximum use of common parts for their different models.

Reports indicate that the industry in other countries also has long recognized the advantages of such rationalization of production; that such rationalization is being implemented to considerable national advantage; and that their present problem is one of finding ways and means of accelerating and widening this development. And standard-

ization of vehicle models and/or components is being applied only where it is certain that such a course will improve or maintain the quality of the product. Arbitrary 'levelling' is carefully avoided.

There are at present about 184 models of cars and trucks in India. The Panel on Automobiles and Tractors in their Report to Government in 1947 recommended that production should be confined in the preliminary years to passenger cars of two ratings only, viz. 8-10 h.p. and 20-25 h.p., and to popular standard trucks of 134" and 158" wheel base. And the committee appointed by Government in 1949 were of the opinion that the number of different sizes and types of car would have to be drastically reduced. By such a reduction, they said, it would be possible to reduce the different types of components and thereby increase the number of the type to be manufactured.

In view of the fact that about 4,000 items are required for the manufacture of a motor vehicle, it is apparent that no single company can make all the components. Extensive subcontracting is inevitable.

The price of components accounts for a large proportion of the total cost, and particularly so in the case of commercial vehicles. On an average, it is estimated that about two-thirds of the factory value of a car is bought by the automobile producer from outside suppliers, and that a large part of this outside purchase is from manufacturers of components.

Expert opinion has it that many of the components, within limits, are capable of standardization, and to a far greater extent if accompanied by a reduction in the number of vehicle models. Economy of production (this will take some time to be effective, particularly where re-equipment is required), increase in production, wider interchangeability of spare parts with consequent saving in stocks to be held for servicing, and greater convenience to the public, are some of the advantages that accrue from components standardization.

The need for implementing such a process in India is self-evident. The first step appears to lie in the correct planning of manufacture. For this, an extensive survey of existing facilities is essential to determine the best mode of harnessing such facilities; and reliable information has to be obtained as to the possibilities of developing local manufacture of items not at present produced in India and the technical requirements of such items of manufacture.

It is well to remember in this connexion that standardization places a heavy responsibility on the authority which chooses the standards. Lack of either care or knowledge might have serious consequences on the future of the Indian industry. It has to be introduced in a manner that will not hamper, even if it does not accelerate, current production and technical progress.

Standards are not static. They are capable of evolutionary development.

The establishment of a chain of subsidiary companies to manufacture automobile components in different parts of the country, each firm specializing in a group of allied items, is a possibility. It could be done in two ways :

1. A co-operative effort by automobile companies ;
2. State enterprise.

In view of the present feverish jockeying for position in the market, one may be forgiven doubts as to the practicability of a joint effort by the industry. The spirit of co-operation is not easily engendered. It requires a mature appreciation of common needs which unfortunately has not yet grown up. State enterprise as an alternative is even less likely to take shape, at any rate for some years to come, owing to the state of the country's finances.

True, the problem involves difficult technical considerations and may result in far-reaching changes in the industry. For instance, the present link-up with foreign manufacturers requiring the manufacture of vehicles to the original specifications and standards of quality may prove to be a serious obstacle.

But effort and change are a condition of progress. In view of its experience in manufacture and knowledge of market reactions, the industry alone is qualified to determine the extent of reduction in the number of models and types of vehicle necessary and desirable. To this task the automobile industry should apply itself resolutely if its proclaimed object of ultimately bringing the cost of motor vehicles within the reach of a much wider range of the public is to be achieved.

Rubber Components

India is in the singularly happy position of having a rubber plantation industry collateral with a manufacturing one large enough to absorb her raw rubber. By far the bulk of raw rubber requirements is met from home sources, i.e. the South Indian plantations. Self-sufficiency is being sought, and steps are being taken to increase both the yield per acre and the overall output of raw rubber.

Apart from tyres, there are about 300 rubber components used in the making of a modern motor vehicle. And the automobile industry accounts for about 80 per cent of the total consumption of natural rubber in India. Between two industries, inter-dependence—technical and economic—could scarcely be more complete.

The rubber industry in India dates from 1920, when factories were started for the proofing of fabrics and the production of rubber-covered

cables. Towards the thirties, plants were established for the manufacture of railway and technical rubber goods and rubber footwear. Direct relationship with the automobile industry was established only in 1936 when the Dunlop Rubber Co. (India) Ltd. started manufacture. It widened with the formation of the Firestone Tyre & Rubber Co. of India Ltd. in 1939.

In less than two decades the industry has been able to meet India's needs and provide employment for a large number of workers while producing an invaluable saving in foreign exchange. In this brief survey it may be enough to give an account of its present position and possibilities with specific reference to the automobile industry.

Begun during World War II, the manufacture of certain rubber parts, such as fan belts, radiator hoses and motor pump connexions, has made much progress. Adequate capacity has been installed, and the quality has improved. A wide range of rubber parts for several types of cars and trucks is now being produced.

Some of these parts, such as brake hoses, are very important in an automobile. Indeed, many of them should not be used till they are tested and found satisfactory. The need for strict adherence to standards in manufacture cannot be over-emphasized ; and this can largely be met by closer co-operation between rubber and automobile manufacturers. As a beginning, the automobile sector could furnish the rubber components manufacturers with the right drawings and specifications of the spare parts required.

The multiplicity of models of cars and trucks has to some extent retarded progress. Both price and quantity have been affected. The recent decision to reduce the number of models should help to consolidate much that has been achieved. Manufacturing capacity covers most of the sizes of automobile tyres and tubes commonly used in the country.

Most of the ingredients are imported. Sulphur and carbon black come mainly from the U.S.A. Attempts are being made to manufacture carbon black in India, but production is still meagre. The National Chemical Laboratory, Poona is at work on a pilot^s scheme for the manufacture of carbon black from Indian mineral oils. The supply situation should improve with the establishment of oil refineries. A high proportion of requirements is likely to be met from this source. The steel materials required are found from Indian sources ; only special steels, not available in India, are imported. Imports have been costly, and heavy duties have had their effect on prices. The drawback allowed (i.e., the refund of import duty on raw materials used in the manufacture of articles that are exported) has been of some help ; but relief seems to lie largely in a progressive reduction of import duties.

Indian sources of supply for some of the other materials required for tyre manufacture have been found. Perhaps much sooner than many expect, the dutiable content of a tyre may diminish and have a salutary effect on prices. Indeed, it is hoped that not all the factors now responsible for the upward pressure on prices will persist; and those that do may be tempered by the attempts being made to improve the general economic condition of the country.

The table below shows the production situation during the years 1947-52 :

		Tyres (000s)	Tubes (000s)
1947	...	810.0	820.8
1948	...	770.4	750.0
1949	...	686.4	702.0
1950	...	638.4	698.4
1951	...	870.0	820.8
1952	...	721.2	661.2

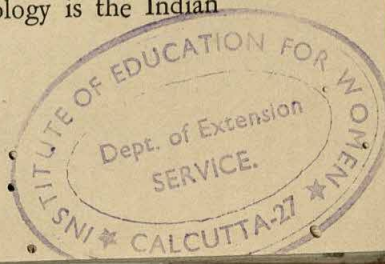
Progress in more recent years is summarized below :

1953				1954		
	No. of Units	Capacity	Production	No. of Units	Capacity	Production
Tyres	2	9,25,200	7,67,899	2	9,25,200	5,32,774
Tubes	2	9,25,200	6,58,479	2	9,25,200	7,48,694

In quality, the Indian product is said to equal the best of foreign manufactures. Indian grading is strictly in accordance with the world standard set by the Rubber Manufacturers Association in New York. Machinery is modern, and its operation and maintenance are in the hands of qualified technical personnel. Schemes in force for the technical training of Indian staff in associated factories abroad augur well.

Research is still in the rudimentary stages. Such work as is being done at the laboratories of the Imperial Chemical Industries (India) Ltd. in Bombay and Calcutta, while doubtless valuable in itself, is hardly adequate to meet the needs of a whole industry. Action has yet to be taken on an important recommendation of the Tariff Board about the establishment of an All-India Rubber Technological Institute.

The industry calls for a high standard of technical knowledge and skill, particularly from those in charge of manufacturing processes. Facilities for the study of rubber science and technology in Indian universities are as yet limited. The only institution conducting examinations for diplomas on rubber science and technology is the Indian



Section of the Institution of the Rubber Industry (London) in Calcutta. The possibility of starting post-graduate courses in rubber technology at the Indian Institute of Technology at Kharagpur is under study by an expert committee constituted by the Government.

Prices have risen. The rise has been attributed with varying degrees of emphasis to the following causes :

1. Increased labour costs ;
2. Prohibition of imports of tyres of sizes made in this country ;
3. Cost of Indian raw rubber.
4. Statutory regulation of purchases from abroad : Indian manufacturers are obliged by statute to take their requirements of raw rubber from indigenous suppliers and only after the entire production of Indian raw rubber has been consumed are imports of the far cheaper foreign rubber permitted ;
5. Excise duties on tyres ;
6. The high rate of duty on essential raw materials, carbon black and accelerators which have to be imported and
7. Low offtake as a result of a fall in vehicle sales.

With so many inflationary factors in operation, the wonder is not that prices are high but that they are not even higher. And the rise in the general level of prices has, indirectly yet effectively, been another cause. That, in comparison, the rise in the price of tyres has not been disproportionate is no mere consolation : it is a basis for hope, and this basis has been broadened by recent developments.

The market in India is large and expanding.

In addition to meeting home requirements, the industry is exporting tyres and tubes to several countries. Due to the high cost of Indian rubber and of imported chemicals, export markets have been difficult to hold.

Vehicle Production

The table below shows the number of cars and trucks assembled during the years 1949-52 in India :

Year		Cars	Trucks
1949	...	6,672	15,132
1950	...	6,588	8,016
1951	...	12,385	9,884
1952	...	6,952	8,339

The statement below summarizes the situation in 1953 and 1954 :

	1953	1954
Number of Units*	12	9 ^B
Installed Capacity (Numbers)	84,014 ^A (Assembly)	40,000 ^C
Actual Production (Numbers)	13,926 (4,936 cars and 8,990 trucks)	14,462 (5,435 cars and 9,027 trucks)

^A Capacity assessed by the Tariff Commission.

^B This includes certain pure assemblers also, who will cease assembly of motor vehicles shortly as a result of the acceptance of the Tariff Commission's recommendations.

^C Manufacturing capacity of six firms whose schemes for the progressive manufacture of automobiles have been sanctioned by the Government of India.

The principal factors responsible for a fall in production during 1953 were a slight slackening of demand, the closure for some months of one of the main plants and the readjustment within the industry as a result of the new policy for automobiles announced by the Government.

The Planning Commission visualized the production of 30,000 automobiles and a proportionate increase of component parts in 1955-6.

Even if data for India and other countries were available on an identical basis, comparisons of productivity would have to be interpreted with great caution. An interpretation based on crude quantity terms would mean little, for conditions in all countries have not been, are not, and perhaps could never be, the same.*

The size and wealth of the population, the area of the territory, the relative thickness of the railway network, the availability of fuel and the character of previous established industries—all these have contributed to make the scale of motor vehicle manufacture in many foreign countries far larger and its efficiency far higher than in India.

In other words, the manufacture of automobiles in an industrially backward country like India presents a set of difficulties quite different from, and less tractable than, those in other countries.

Even allowing for the defects inherent in India's economy, manufacture in this country is almost insignificant. An analysis of the production position and possibilities is hence essential.

The causes for such poor production are many. But they may be divided broadly into four categories :

1. The general industrial backwardness of the country.
2. Scarcity or non-availability of certain raw materials and components.
3. High prices of components available.
4. Lack of indigenous technical skill.
5. The small demand in India for automobiles.

Capital invested in the industry is adequate. In 1951, it was estimated to be in the neighbourhood of Rs 930 lakhs ; indeed, it seems, in the light of the present market for motor vehicles, that it is far larger than is actually required. Some automobile companies are expanding operations. Additional capital invested during the years 1951-4 has been assessed at 112 lakhs of rupees. The latest reports put the total paid-up capital, as on 31 December 1954, at just over Rs 13.22 crores, of which foreign capital is said to be about Rs 14 lakhs. Foreign capital is welcome, for it will, as the Panel on Automobiles and Tractors has observed, 'prove beneficial in the long run as a guarantee of continued interest both in the quality of performance and the establishment of sound traditions'.

The industry employs about 7,100 workers, of which 3,443 are skilled and semi-skilled.

Imports

During the years 1933-9, India imported on an average 12,313 cars and 9,605 trucks—a total of 21,918 vehicles per year. A significant and perhaps regrettable feature of these imports was the ratio between cars and trucks. Records show that in some years, as in 1934, India was the largest purchaser of foreign vehicles of any country in the world.

In 1937-8, Britain was the largest supplier of cars by numbers, imports from Britain amounting to nearly 7,000 compared with about 6,500 from the U.S.A., but the total value of imports from American motor manufacturers was about 25 per cent greater than that of purchases from Britain. Imports of trucks from the U.S.A. were substantially larger than from Britain, and indeed from all other countries. During the war imports were obtained from Canada and the U.S.A.

The statement overleaf summarizes the import situation from 1 April 1950 to 31 March 1954.

Principal articles	1950-1		1951-2		1952-3		1953-4	
	Number	Value in Rs	Number	Value in Rs	Number	Value in Rs	Number	Value in Rs
Vehicles (excluding locomotives, etc. for railways), mechanically propelled vehicles (excluding railway locomotives and tractors), motor-cars (including taxicabs)								
From Britain	7,395	2,73,04,459	8,237	3,71,58,628	3,598	1,91,44,917	3,455	1,43,53,136
From the U.S.A.	406	28,14,795	1,422	91,29,553	1,348	89,91,748	2,232	1,28,98,361
From other countries	632	23,04,295	304	16,54,589	214	14,55,765	124	9,81,877
Total	8,433	3,24,23,549	9,963	4,79,42,770	5,158	2,95,96,630	5,811	2,82,33,374
Motor omnibuses, motor vans and motor lorries								
From Britain	2,396	1,70,54,654	1,595	1,17,08,759	1,404	1,40,16,518	1,702	1,58,97,333
From the U.S.A.	2,284	1,29,08,328	2,960	1,75,45,975	2,144	1,49,99,917	2,479	1,66,84,831
From other countries	223	13,43,099	157	4,22,669	89	6,43,437	8	1,04,881
Total	4,903	3,13,06,081	4,712	2,96,77,403	3,637	2,96,59,872	4,189	3,26,87,045

[Source : Accounts relating to the Foreign (Sea, Air and Land) Trade and Navigation of India for March 1954.]

India's imports have involved unexpectedly large drafts on the sterling balances accumulated during the war. The shortage of foreign exchange for the industry has resulted in a lowering of the import ceilings.

Imports of automobiles till recently came under one or the other of the following categories :

1. Completely assembled cars.
2. Cars in Semi-knocked-down¹ condition.
3. Cars in Completely/knocked-down² condition.
4. Cars in Completely knocked-down² condition less certain components available in India.
5. Castings and forgings in the rough, with the rest of the components imported in CKD condition less certain components available in India.

The import of built-up cars into India is now prohibited. Relaxation is permitted only in cases where the following conditions are satisfied : (a) Indian nationals concerned should have had the car in their ownership and use for at least six months prior to shipment, and (b) they should undertake not to re-sell the car in India within a period of one year. This concession is not extended to Indian nationals who go abroad for purposes of study. The import duty is 75 per cent *ad valorem*³ or Rs 6,000 per car or cab, whichever is higher.

With the exception of those items which are produced within the country (e.g. tyres and tubes, batteries, fan belts, rubber parts [about 20 in number], cushions, cab bodies, pistons and cylinder liners), imports of motor vehicle components are permitted.

In 1949 the Minister of Industry and Supply appointed a committee to go into the question of the manufacture of automobile components in India—what the then existing capacity was and what programme for the future should be drawn up—and to submit its report within two months to enable the Government to take a decision and formulate its policy. This committee included, besides representatives of concerns having a manufacturing programme, representatives of other automobile concerns and of the Ministries of Transport, Defence, Finance, and Industry and Supply.

The committee submitted a detailed report in July 1949. This report was considered by the Government of India and it was decided to make certain changes in the import tariff on automobile

¹ Abbreviated to SKD *passim*.

² Abbreviated to CKD *passim*.

components. The proposed changes in the tariff were introduced as part of the Budget proposals for 1950-1.

The Government of India, after detailed consideration of the committee's report, decided :

1. That licences should be granted for the import of motor-cars, motor vans, trucks and lorries only in CKD condition ; and that for purposes of import, only recognized assemblers of cars from CKD condition and manufacturers were to be given monetary allocations.

2. That components should be divided into three 'lists' :

- (a) Components already being manufactured in India ;
- (b) Components likely to be manufactured in the next two years ;
- (c) Components which are not likely to be manufactured in India within the next two years ; and

3. That import duties on components should be revised as follows (in percentages) :

	Cars		Trucks	
	U.S.A. (Standard)	U.K. (Pref.)	U.S.A. (Standard)	U.K. (Pref.)
LIST (a)				
Existing rate ...	60	54	30	21
Revised rate ...	60	54	60	54
LIST (b)				
Existing rate ...	60	54	30	21
Revised rate ...	90	84	90	84
LIST (c)				
Existing rate ...	60	52	30	21
Revised rate ...	30	22½	30	22½

The increased import duties on automobile components were the subject of considerable comment. During the debates in Parliament on the Finance Bill some members pointed out :

1. That the increased tariff on imported parts of automobiles would not only increase the sale price of motor vehicles but also the cost of repairs.

2. That the increased cost of transport which would follow from the levy of high rates of duty would be passed on to the consumer by operators of transport services.

3. That the increased cost of trucks would eliminate a considerable number of persons who operated transport services.

4. That such high duties on automobile components might lead to the creation of a monopoly.

In support of the Government's action, it was pointed out that protective duties were essential for the growth of the indigenous automobile industry.

Dr. Matthai, the Finance Minister at that time, in his reply to the debate, made the following proposals and suggestions :

1. The Government proposed to set up immediately an expert committee sufficiently conversant with the technique of the motor-car industry to re-examine the whole position with regard to the inclusion of particular parts in categories bearing different rates of duty.
 2. The Government proposed to introduce a scheme of rebates for the benefit of users of public service vehicles.
 3. The Minister of Industry and Supply proposed to call a conference immediately of distributors of motor vehicles with a view to seeing how far the existing level of distribution and incidental charges could be reduced.
 4. It was the intention of the Government, if assistance were granted to the industry, to make arrangements to exercise a careful and continuous watch over its progress in order to see that the anticipations on which the Government based its proposals materialized.
 5. In view of the announcement about the reduction in the price of petrol, the increase in maintenance charges which might very likely occur in connexion with the transport services would, to a considerable extent, be mitigated.
- An expert committee was appointed.

The main assemblers agreed, at the instance of the Government, 'to make certain reductions in their selling prices and also to quote a net price at which they would supply all dealers and large-scale consumers, subject to a minimum value limit for each sale'. In effect, this meant that the larger consumers and dealers would get the spare parts at the same prices as the authorized agents. Import policy was liberalized to allow for a freer flow of spare parts. Licences were issued, not only to the recognized assemblers and established importers, but also to those owning a fleet of vehicles, as well as to those who were in the spare parts trade and were prepared to import on a substantial scale.

In regard to restricting the dealers' margin, the Government felt that dealers should not be allowed to take advantage of the adventitious rise in the landed cost of automobile parts and components consequent upon the revision of import duties, as they would not be rendering any additional service, and that it would be sufficient if the quantum of profit was maintained at the previous level—though in terms of percentage it might be less. It consulted leading automobile firms in India on this question, and all the firms agreed to fall in line with the Government policy.

The battle still continues. It is argued that

1. The revised import duties on motor-car components are causing considerable hardship to motorists and the trade and are out of all proportion to the national benefit that can be hoped for.

2. That they might, if continued, retard the progress of road transport which is of vital importance to the country.

3. That while India is not yet able to produce even a complete bicycle, there should be an emphasis on the lighter industries; hence, legislation increasing the import tariff on automobile components can only be looked upon as being extremely premature; and that such legislation is not based on a proper study of manufacturing probabilities.

4. That as the enhancement of duty, causing a rise of about 30 per cent in the price of components, came closely in the wake of devaluation, which raised the price of U.S. vehicles by about 44 per cent, the demand for American cars, passenger and goods vehicles has almost vanished.

Alongside these points, to get a proper perspective, must be placed the following :

1. That unless increasingly prohibitive duties were imposed on imported materials it would be impossible to develop the indigenous components manufacturing industries.

2. That the history of the industry in Britain shows clearly that the industry has been protected from foreign competition to an unusual extent and for an unusually long time and that it has benefited from preferential tariffs in Commonwealth countries; and that, 'in the earlier stages of the industry, some European countries levied a huge protective duty, as high as 100 per cent'.

3. That the Fiscal Commission has observed : 'The need for an assurance prior to the actual establishment of an industry is particularly strong in those industries which require heavy capital outlay or a high degree of specialization in personnel and plant equipment and are likely to be subjected to intense competition from well organized and established producers abroad.'

In the final analysis, it seems that a careful gauging of the shift in comparative advantage is an essential preliminary to any planning that the State and/or the industry might undertake, and that only thus can the right admixture of import curtailment and internal production be obtained.

In March 1952, the Tariff Commission was asked to examine the general question of the grant of protection to the automobile industry in India. In May 1952, the Ministry of Commerce and Industry specified the issues on which the Government sought information and advice. The aim, it said, was to protect, assist and facilitate

the speedy growth of the automobile industry in India on a sound basis. The Tariff Commission was asked, in particular :

1. to examine the manufacturing programmes (present and proposed) of Hindustan Motors and Premier Automobiles, as well as of the industries engaged in the production of essential components for these units, and report whether they were technically sound and their implementation would result in the manufacture of vehicles at a price which would permit of an expanding demand and, if so, by what date ;
2. to examine and report on the possibilities of either integration or mutual assistance and co-operation of existing manufacturers/assemblers of motor vehicles with a view to utilizing the total existing capacity to the best advantage and promoting the development of the automobile industry as a whole ;
3. to examine and report on the steps necessary to encourage the growth of ancillary industries ;
4. to examine and report on the arrangements for the import of vehicles, accessories and raw materials necessary to meet the requirements of the industry and the public ;
5. to examine and report whether any change in the existing rates of import duty on components of motor vehicles was required and, if so, in what respect ; or whether the grant of a subsidy would be suitable and, if so, what conditions should be attached to it ; or whether a combination of both these methods should be adopted ; and
6. to investigate and report on the economics of Diesel-driven transport vehicles and the desirability of taking measures to restrict, regulate or co-ordinate their use with the use of petrol-driven vehicles.

In a resolution on 31 May 1953, based on the recommendations of the Commission, the Government of India announced the broad lines of its policy on the automobile industry. These were mainly as follows :

- (1) the concentration of the demand on manufacturing firms ;
- (2) the restriction of manufacture to a few selected types and models ; and
- (3) the reduction of import duties on components.

In pursuance of the above, firms having manufacturing programmes were asked to send them to the Government for scrutiny and approval.

(Firms which were merely assembling, as apart from manufacturing, were constrained to cease operations.) Sanction has been accorded, so far, to the following firms for the progressive manufacture of the types of motor vehicles shown against them :

Name of the Firm	Type of Vehicle.	Trucks/passenger chassis
1. Hindusthan Motors Ltd., Calcutta.	Hindustan 14 (Light Car) Studebaker (Big Car) Morris Minor (Baby Car)	Studebaker (Medium Truck)
2. Premier Automobiles Ltd., Bombay.	Dodge Desoto Plymouth Fiat 1100 (Baby Car)	Fargo Desoto Dodge } (Medium Trucks)
3. Standard Motor Products of India Ltd., Madras.	Standard Vanguard (Medium Car) Standard Light (Baby Car)	
4. Ashok Motors Ltd., Madras.	—	Leyland (Diesel)
5. Tata Locomotive & Engineering Co. Ltd., Bombay.	—	Tata Mercedes-Benz (Diesel)
6. Mahindra and Mahindra Ltd., Bombay.	—	Willy's Jeep

These programmes are all for a three-year period commencing from 1954, and contemplate the manufacture of the essential components of the vehicle. It is expected that over the next three years, a minimum of 50 per cent of both a car and a truck would be manufactured within the country. Some of the schemes envisage the manufacture of as much as 75 per cent of the vehicle. In the case of the jeep, the firm has undertaken to manufacture 69 per cent of the value of the components within three years.

If these programmes are completed according to schedule, the position would be as follows :

- (a) *Cars*—Three makes of baby cars, two makes of light and medium cars and two makes of heavy cars would be produced in the country.

- (b) *Commercial Vehicles*—A diesel five-ton truck, two makes of three-ton petrol trucks and one make of three-ton diesel truck would be produced.
- (c) *Jeeps*—A four-wheel drive vehicle of the jeep class would be produced.

Indian Demand for Vehicles

In 1940 the number of motor vehicles in use in India was :

Motor-cars	...	...	85,771
Motor cabs	...	...	6,070
Motor lorries	...	...	13,579
Motor buses	...	...	23,330
Total			1,28,750

By 1946, the number had risen to about 1,60,000, composed of :

Motor-cars (including cabs)	...	1,05,000
Motor buses, lorries, etc.	...	55,000
Total		1,60,000

According to the Ministry of Transport (*Basic Road Statistics for India, First 1950 Supplement*), there were in India (excluding States) 1,78,299 motor vehicles.

The world census for 1952 showed that India had the largest number of motor vehicles in Asia. The figures were : India, 2,74,206 ; Japan, 1,63,325 ; the Philippines, 96,650 ; Indonesia, 64,800 ; Ceylon, 63,016.

According to the returns from the State Governments for 1950-1, the number of motor-cars in India was 1,45,290 ; public service vehicles, 42,222 ; goods vehicles, 83,161 and miscellaneous vehicles, 3,588.

In March 1953 there was a total of 3,33,219 vehicles excluding tax-free vehicles. This represented 87 vehicles per lakh of population.

Particularly noticeable in the figures above is the preponderance of private cars in use in the past. Perhaps this persists to this date, although it may be less in terms of percentages. It is learnt that the present demand is about equally divided between private cars on the one hand and buses and commercial vehicles on the other.

At present, production is limited by demand, and the sale of motor vehicles by various Government Disposals departments, and to a less

extent the sale of second-hand cars, have aggravated the situation. The problem of surplus capacity might become serious. Subjoined is a statistical summary of sales in recent years :

Year	Cars	Trucks	Total
1952	8,212	7,503	15,715
1953	5,000	4,400	9,400
1954	5,806	8,007	13,813

The annual demand from 1954 onwards was estimated to be of the order of 40,000 to 50,000 vehicles. This has fallen far short of expectations. How much further the market will change and in what directions is difficult to say.

The larger companies which have installed expensive equipment and engaged the services of highly qualified foreign technicians are alarmed at the sales prospects and at the effect of idle capacity on costs ; for the more nearly plants approach capacity operations, the greater will be the economy in the cost of production. The smaller companies are conscious of their weaker position in the field ; and their fears as to whether, in open competition with formidable rivals, they will be able to sell even the economic minimum are understandable.

The overall picture is certainly not one of easy profits. Supply seems potentially far greater than demand. It is difficult to say how many of the smaller firms will survive the rigours of their economic environment. However, automobile companies have not combined for protection of prices, division of markets or other similar restrictive practices. The history of the automobile industry in Britain and the U.S.A. reveals that in both countries the growth of manufacturing capacity has been matched by a reduction in the number of firms by concentration and amalgamation. The recent Austin-Morris merger is a case in point. Such developments are not without significance to the Indian industry.

There is little doubt, however, that the demand is potentially strong. For instance, State-operated services exist in a large number of States—twenty out of the twenty-eight—and nearly Rs 20 crores have already been invested in public transport services, and a further investment of about Rs 9 crores by State Governments was envisaged in the First Five-Year Plan. With the increase in food production and rising tempo of industrialization, public service vehicles will be in great demand. A target of 1,00,000 vehicles a year is contemplated.

Latterly, a rift has appeared in the structure of the industry ; and the indications are that, despite the most strenuous attempts at repair, it is gradually widening. The cause has been the conflict of interests

between the better equipped and the poorly. The situation in the industry generally does not lend itself to any clear differentiation between assemblers and manufacturers. The operations of most automobile companies are an amalgam of assembly and manufacture. There has been progress in the manufacture of components; but the pace has varied with each company. Some are able to produce the more important ones, others the less.

Automobile companies technically more advanced than the others ask :

1. That out of the exchange available for the import of automobile components, their requirements should be met by the Government in full and the balance distributed among others ;

2. That in the purchases of automobiles made by the Central and State Governments, preference should be given to automobiles which contain the maximum number of indigenously manufactured components ; and

3. That increasing restrictions should be imposed by the Government on the import of ready-made components for assembling motor vehicles in the country. It is only by the implementation of such a scheme, they add, that the survival of the indigenous industry can be ensured.

The weaker members contend that such a course would inevitably lead to the establishment of a monopoly—a possibility that cannot be rejected out of hand. A compromise has to be found ; it is on this obviously difficult task that the Government has been long engaged.

Retail Sales

The retailing and repairing of motor vehicles—as essential to national economy as manufacture—forms a trade of considerable importance. The structure of the trade has been strongly influenced by the keenness of competition in the automobile industry before the war. Producers thought it best to multiply the number of retail outlets for their cars. The trend changed during the war—perhaps because such a widely dispersed programme of sales did not prove advantageous—towards larger and fewer units. Increasing competition among automobile companies in India may soon find expression, as has happened in the U.S.A. and Britain, in the development of efficient after-sale maintenance services—an important sales asset. The shortage of skilled labour is causing anxiety.

On the closure of some of the assembling firms, the Government suggested to the 'manufacturing' firms, the absorption of the skilled workers rendered surplus and the utilization of the organizations built

up by those firms for servicing distribution. Not much has been done so far in either direction.

Trade organizations connected with the automobile industry are singularly few in India. Other than the Automotive Manufacturers' Association of India, which was formed to promote the interests of automobile manufacturers, none has come to notice. An organization similar to the Society of Motor Manufacturers & Traders Ltd. in Britain is a necessity. It could, for instance, undertake market research on popular taste on behalf of the industry; keep its members informed of the latest import regulations; advise them on legal enactments regarding weight, brakes, lighting, etc., and circulate reports received from foreign countries of technical developments in the automobile industry.

Equally necessary would be a National Advisory Council for the automobile industry on a permanent footing, composed equally of Governmental and commercial representatives, to provide a means of regular consultation between the State and the industry on such matters as the location of industry, imports, exports, research, design, technical development and production methods. *Ad hoc* committees to advise the Government are of little avail in the circumstances in which the industry finds itself today.

Vehicle Prices

Prices of automobiles vary according to their horse-power and make. The devaluation of the Indian rupee resulted in an increase in the Indian market price for American cars and trucks; and the revised import duties on automobile components from the year 1950-1 led to a further rise—considerably higher in the case of trucks—in the prices of cars and trucks.

In terms of averages the prices were roughly as follows :

Old Price	New Price	Difference
Rs 11,668	Rs 12,336	Rs 668 Cars (U.S.A.)
Rs 11,948	Rs 12,635	Rs 687 Cars (U.K.)
Rs 9,315	Rs 11,844	Rs 2,529 Trucks (U.S.A.)
Rs 10,238	Rs 13,460	Rs 3,222 Trucks (U.K.)

The effect of such steep increases in prices on sales can well be imagined. The fall in the value of the rupee in terms of the dollar, which was largely responsible for the rise in prices, is a factor to which India will have to reconcile herself for some years to come. But there are other inflationary elements which can, with effort, be eliminated.

It is obvious that the fight against high prices should, for some time at any rate, be the main concern of the Indian automobile industry.

Only if that fight is won can the industry hope to play a significant part in the national economy. And to win, there has to be a constant search for economies in cost and for the type of product which will command a market.

Two possibilities, apart from the forms of State assistance referred to above, suggest themselves :

1. Reduction in the number of vehicle models.
2. Standardization of components.

Developments in these directions in other countries merit mention in this context. The production of motor vehicles in the U.S.A. is on a scale unequalled elsewhere either in volume or variety. Volume-producers have achieved remarkable results in terms of output by standardization at the earlier stages of manufacture ; and the production of the special and semi-special makes has been so arranged as not to prejudice the manufacture of cheaper models.

In Britain, at the end of 1947, there were only 62 basic models compared with 136 in 1939. The process continues, and it is hoped that the number of models will soon be reduced further to 42, representing a total reduction of about 70 per cent, and that body variations will also by then have been reduced from 299 to 40, representing a reduction of about 87 per cent.

Government Policy

The late Planning and Development Department of the Government of India set up a Panel on Automobiles and Tractors, and its report was published in January 1947. The Panel recommended that the Government should take steps to encourage this industry because of its importance in national development. It also recommended that production should be confined in the preliminary stages to passenger cars of two ratings only—8-10 h.p. and 20-25 h.p. ; that trucks of popular standards, e.g. 134" and 158" wheel base, should be manufactured, and that capacity should be developed for forgings and castings.

In its Resolution on Industrial Policy dated 6 April 1948, the Government of India classified the manufacture of automobiles and tractors among those basic industries, the planning and regulation of which by the Central Government was necessary in the national interest. But the industry was not placed on the State enterprise list.

Subsequently, representations were made to the Government by companies with manufacturing programmes that, unless they were given sufficient protection against foreign competition, it would not be worth their while embarking on manufacturing schemes.

The Government recognized that the problem of protection in rela-

tion to the development of manufacture within the country involved difficult technical considerations, and was hence in no way disposed to prejudice the extent to which protection was desirable or practicable. It regarded as fundamental and urgent, particularly in view of conflicting opinions on the subject, that it should have the best assessment possible of the extent to which manufacture already existed, and of the degree of tariff protection that was considered essential in the light of commercial experience and judgement.

The Government was of the opinion (Resolution on Industrial Policy dated 6 April 1948) that the location of the automobile industry must be governed by economic factors of all-India import; in other words, that there should not be an unco-ordinated growth of automobile assembling and/or manufacturing establishments. The Panel on Automobiles and Tractors (1947) recommended location near general engineering industries which might provide components and other materials for the industry. The establishment of new units in central parts of India also formed part of their recommendations. But high costs of distribution seem to favour the establishment of small plants situated in each of the main States, and this, incidentally, would be in consonance with the policy of regional distribution of industries. Such regional distribution would have a defence significance also, although it might not be logical on grounds of productive efficiency.

Between these opposing factors a balance has to be found and maintained. And no less necessary is it for the State to maintain a balance between the needs of the railways and road transport for development. It is highly improbable that the railways will ever be superseded either for long distance, and especially overnight, passenger traffic, or for the carriage of heavy and bulky goods. A country's communications can develop only when all the various forms of transport are treated as complementary and not competitive to one another.

• *Road Development*

There are a number of other forms of State assistance which are necessary and desirable. The development of roads is an instance. A vast network of feeder roads is essential if road transport is to increase and, indeed, if the best use is to be made of the transport now available.

India has 2,55,000 miles of roads of which only about 36 per cent are surfaced. She has barely 9.7 miles of all-weather roads for every hundred square miles. The condition of the roads, with minor exceptions, is execrable. Every unevenness is announced to the spine; and disintegration has increased with the growth in traffic. The Indian

Roads and Transport Development Association (IRTDA) in its memorandum to the Government in February 1950 showed how good roads could reduce transport costs by 3 to 5 annas per truck mile, a factor which may mean all the difference between a decadent and a flourishing industry.

IRTDA suggested action in the following directions :

1. Rational system of motor vehicle taxation.
2. Removal of restrictions under the Motor Vehicles Act.
3. Removal of restrictions on vehicle weights.
4. Removal of proposed mileage restrictions on motor transport.

The Association also recommended to the Government the allotment of a minimum of 9 per cent of the Central and State revenues for roads. (India at the commencement of the war was spending barely 3 per cent of its revenue on roads as against 6 per cent in Britain, $7\frac{1}{2}$ per cent in France, and $8\frac{1}{4}$ per cent in the U.S.A.)

The revenue to the Government from the import, operation and maintenance of about 3,08,000 motor vehicles in India comes approximately to Rs 45 crores a year. Judging from this, it would appear that, were the industry given the support which foreign countries gave their indigenous automobile industry in its initial stages, it might become an increasingly rich source of revenue to the State.

In his address to the Rotary Club of Calcutta on 25 July 1950, Sir L. P. Misra presented the crux of the problem. He said : 'Government have spent about Rs 200 crores on roads and they are realizing about Rs 28 crores per year from motor transport (about 14 per cent) ; and only a fraction of the Rs 28 crores is being utilized for the improvement of roads ; the result is that transport continues to be expensive on the one hand, and cannot, on the other hand, expand to meet the growing needs of the community for want of roads.'

Latterly, however, there has been evidence of effort. A provision of Rs 100 crores was made in the First Five-Year Plan for the development of roads. The construction of nearly 3,000 miles of new roads and 16,000 to 17,000 miles of village roads through community effort is contemplated. During the years 1951-3, Rs 7.4 crores were spent by the Central Government on the development of national highways while the States incurred an expenditure of Rs 26.82 crores on State roads.

Taxation

A reduction in the number and quantum of taxes on motor vehicles is another possible means of State assistance to the automobile industry.

Heavy taxes—Central, State and municipal—have been imposed on all types of motor vehicles. A list is given below :

Central Taxes

1. Import and excise duties on motor vehicles, parts and accessories, tyres and tubes, machinery and other materials required for the motor transport business ;
2. Import and excise duties on motor spirit, power alcohol, diesel oil, lubricants.

State Taxes

1. Taxes on motor vehicles ;
2. Permit charges and inspection fees levied on transport vehicles and buses ;
3. Driving licence fees ;
4. Other miscellaneous fees ;
5. Sales tax on motor vehicles, spare parts, fuel, lubricants and other items ;
6. Taxes on goods and passengers carried by road ;
7. Tools ;
8. Pilgrim and other taxes.

Taxation by Local Bodies

Local taxes include municipal vehicle taxes, wheel taxes, tolls and octroi duties, rent for bus stands, and other taxes or charges.

As pointed out in the section on road development, the income to the State from the import, operation and maintenance of motor vehicles in India is about Rs 45 crores per year. The amount which each motor vehicle owner pays Government yearly for the use of his vehicle has been variously estimated. The range, however, is between Rs 1,100 and Rs 1,330 a year.

For the use of such roads as have been provided, the extent of annual financial obligation to the State seems disproportionate. Motor vehicle users are not the only users of roads : there are other beneficiaries, e.g. the agriculturists, owners of house property and professional bullock-cart owners. In fairness, their obligations to the State *vis-à-vis* the motor vehicle owners have to be determined.

The modern motor vehicle has been—at any rate in India—more an instrument of industry than of recreation and the present high taxes to which it has been subjected have been, on the whole, an additional tax on trade and industry ; and this additional tax has been reflected in the high cost of finished goods. The cost of transport, and therefore

any tax on transport, enters into the cost of production at each successive stage and is cumulative in effect.

Taxes on spare parts, accessories, petrol (the duty on petrol is 15 annas a gallon and the average State sales tax is as high as 6 annas a gallon) and on tyres and tubes etc., have made motoring in India extremely expensive. The effect of such high cost on the sales of motor vehicles is obvious.

Indeed, it appears that a substantial reduction in the weight of motor vehicle taxation is necessary, on national grounds, if a condition of increasing internal demand leading to higher productivity and lower costs is to be obtained. For this, in the final analysis, constitutes the only basis on which an indigenous industry can be confidently built.

The automobile industry is extremely sensitive and responsive to taxation. It is affected unfavourably by any burden placed upon it, or favourably by any relief of that burden, to a greater degree than any other industry of comparable importance; and these considerations make it peculiarly unsuitable for taxation of a sumptuary nature. A Motor Taxation Inquiry Committee was constituted by the Government to adjust the tax structure so as to assist in the attainment of the proper co-ordination of transport and, in particular, in the provision and development of cheap, rapid and efficient transport for the different categories of users.

The Committee submitted its Report to the Government in October 1950.

Among the important recommendations made were the immediate reduction of Central import and excise duties on motor vehicles and spare parts to the pre-1950 level and retention of these duties on motor spirit at the existing level of 15 annas per gallon; the abolition of States' sales tax on motor spirit and its substitution by a Central surcharge of 6 annas per gallon; and the elimination of all local taxes on motor vehicles and the commodities carried by them. In effect, it meant a tax burden somewhat lower than that existing in some of the States where the tax was high. The Committee recommended also a further lowering of the tax level as soon as the financial position of the country improved.

The Central Government is in correspondence with State Governments in regard to sales tax, with a view to ascertaining what steps can be taken to lighten some of the burdens.

Prospects

The automobile industry is passing through a crucial phase. There is a slow shift of emphasis in State assistance from protection to deve-

lopment. The manufacturing programmes of companies have in the last few years undergone much revision ; indeed, the implementation of six of them has begun. What all this may mean in the aggregate is difficult yet to assess. It is clear, however, that, with the assemblers now virtually out of the field, the industry has a firmer economic base. Even so, the need for care and thought in planning continues. Several obstacles subsist, and the surmounting of them is far from easy. The main obstacles are : the shortage of the right type of raw materials and components, the undeveloped and unorganized state of ancillary industries, the need for improving quality and reducing price, and lack of demand.

The non-availability at home of the right types of steel, as in the case of shipping and a few other industries, is still a distinct source of anxiety. These difficulties over supplies make it more than normally important to accelerate the expansion of the iron and steel sector ; and, especially in the case of the automobile industry, the world market permitting, a quicker and more liberal issue of import licences should be of additional assistance.

An indiscriminate growth of ancillary industries will inevitably result in a higher social cost. Careful planning before, and conscious direction after, their establishment seems essential, and these will need to be followed up by a system of 'products standardization' which, while ensuring quality, will not hinder technical progress.

The reduction in the number of models should make possible a reduction in the number of types of components and an increase in the number of the type of vehicle to be manufactured ; the latter, in particular, will make operations more economic. Apposite in this context is the view of Mr. M. D. Bhat, Chairman of the Tariff Commission, that 'we should be proceeding on right lines if we placed a modest goal before us and endeavoured to reach it within as few years as possible.'

The improvement of quality is another important consideration. Furnishing the engineering industry with the correct specifications for components and association with foreign firms for technical guidance should help here.

Although in large measure due to the essential poverty of the Indian economy, lack of demand is not incapable of correction. Demand could, within limits, be stimulated. For this a bilateral approach seems necessary : a reduction of prices by manufacturers ; and a reduction of the rate and number of taxes on motor vehicles by the Government. If the object of ultimately bringing the cost of motor vehicles within the reach of a much wider range of the public is to be achieved, there must a constant search for economies ; and only when they have been found can there be a large and continuing rise in sales. The liberali-

zation of the tariff on components is at best of limited usefulness. But price reduction presents a conundrum. Only increased offtake can help to reduce prices, and offtake cannot increase unless prices are reduced. Viewed from this angle, the emphasis on the manufacture of baby cars seems rightly placed.

The present annual rated capacity is about 40,000 vehicles, and production in 1954 was 14,462. Requirements in 1955-6 are assessed at 30,000 vehicles, which, to be met, would mean a larger utilization of present capacity. The Planning Commission is reported to have recommended that, by the end of the Plan periods, India should be in a position to manufacture all the motor vehicles she needs. This seems well worth the effort. Both the civil and military requirements of a vast country like India make it imperative that she should be self-sufficient in this regard in the least possible time.

Concentration on tariff protection for development is an outdated economic concept. For the promotion of industry, the Fiscal Commission favours a more pragmatic approach. 'As we see it today,' the Commission observed, 'there was a fundamental defect in the approach of the last Fiscal Commission to the problem of protection. Protection was not visualized as an instrument of general economic development but was viewed as a means of enabling particular industries to withstand foreign competition when they applied for protection.'

Hardly less essential is the need to exercise a careful and continuous watch over the progress of the industry in order that the anticipations on which the Government has based its protection may materialize.

It is comforting to learn that the Government has not abandoned attempts to lower the level and rationalize the multiplicity of taxes on motor vehicles. It should be possible to convince the States that the fiscal benefits likely to accrue at no immensely distant date from a larger number of vehicles would more than counterbalance immediate losses.

Progress there has undoubtedly been in the automobile industry. The need now is to maintain the pace and fulfil the promise of the last few years. Two ways are open; and both have to be explored. They are: first, a generous appreciation of the needs of the industry by the State, accompanied by measures to meet them; and secondly, increased co-operation among members of the industry.

Of the first, indications are that it will be forthcoming. Of the second, hopes are not unwarranted. Out of the meetings being held from time to time to consider common problems may well emerge a form of co-operative effort that will mass-produce standardized, dependable vehicles at a cost cheap enough to make them available to the common man.

CHAPTER IV

DIESEL ENGINES

AN interesting treatise might be written on the contribution of modern machinery to a nation's wealth. In the array of contemporary or near-contemporary inventions, diesel engines play a big, if not always spectacular, part. Their great importance derives from the need for creating and using power wisely and thriftily.

In the lay mind, there is, not unnaturally perhaps, some confusion between diesel and other types of internal combustion engines. The essential feature of the true diesel engine is defined as 'the injection of the oil fuel directly into the water-cooled combustion chamber at or about the end of the compression stroke. Air alone is compressed to a pressure of some 500 lb. per square inch, the resulting high temperature automatically igniting the explosive mixture of air and oil spray. The fuel feed is so regulated that combustion proceeds at approximately constant pressure during a small part of the working stroke.'

In the last few years, the use of diesel engines has grown rapidly in extent and diversity. Space does not permit submission of a functional analysis. General observations must suffice.

These engines are used extensively on both land and sea. On land, they provide power for road and rail transport. They are most useful also in agriculture. They serve the agriculturist by pumping water for the fields and driving agricultural machinery.

As they perform, often unattended, many diverse and arduous duties, with a degree of efficiency otherwise impossible except at the expense of much labour, skill, plant and floor space, it was inevitable that their range of usefulness would sooner or later be extended to embrace a great multiplicity of industrial operations. They entered fields where, hitherto, steam engines held undisputed sway. To those in charge of manufacturing power—to the plant engineer in particular—they recommend themselves by their simplicity and operational flexibility. Their rugged construction enables the utilization of cheap grades of fuels giving high thermal efficiency. As the industrialization of India grows apace, new uses will be found.

At sea, the adoption of diesel engines for propulsion has had several advantages. Here again, an important and valuable feature is the efficient and non-prodigal generation of power. Compared to a steam engine, the diesel has greater thermal efficiency; the fuel bill is less; the plant occupies less space; and there is a saving in personnel.

Possible applications of these prime movers are extremely varied, and their number is constantly growing.

Before manufacture began in India, requirements were wholly met by imports from Britain, the U.S.A., Sweden and other continental countries. The largest exporter to India was Britain.

Production in India goes back to well before World War II. To Cooper Engineering Ltd., Satara must go the credit due to pioneers. In 1932 they commenced the manufacture of internal combustion engines with a range of solid-injection type diesel oil engines in sizes from 7 B.H.P.¹ to 20 B.H.P. These engines were soon in demand for agricultural and industrial uses. Next in the field were Kirloskar Brothers Ltd., Poona, who manufactured, also before World War II, vertical single and twin cylinder engines.

During the war, Kirloskars stopped manufacture owing to the difficulty of obtaining essential components. Cooper Engineering Ltd., however, expanded production greatly, and introduced new types. Immediately after the war Kirloskars revived production, floating a public limited company in 1946. Their programme of manufacture included, to start with, engines from 5 B.H.P. to 200 B.H.P.

There are now in India twelve producing units.

The raw materials required are steel, pig-iron, mechanite castings and some non-ferrous metals. Most of these materials are available in India. Of components, some (for instance, crank shafts, fuel oil pumps, fitters, springs, valves and valve guides, bearings and bushes, piston rings, oil seals, cam shafts) are imported. The absence or shortage of Indian production of these is a disadvantage, but several other industries are similarly placed in regard to components. In recent years the situation has considerably improved.

No specialized machinery is required for manufacture. General purpose machine tools (e.g. capstans, lathes, drilling machines, etc.) are capable of meeting requirements. Foundry equipment is needed for the castings.

The machinery required is imported mainly from Britain.

Most factories manufacturing diesel oil engines produce other items too. The total labour employed in the manufacture of diesel engines is estimated at 2,860, apart from the 3,530 employed in the allied power-driven pump industry. In several manufacturing units there are training cadres for personnel. Some factories have foreign technical assistance.

The industry is now equipped to manufacture engines up to 300

¹ B.H.P.: brake horse-power, the effective horse-power developed by an electric motor as measured by a brake applied to the driving shaft.

B.H.P. The bulk of production, however, is in the range of engines up to 35 B.P.H.

The present total installed capacity in the country is estimated at 14,700 engines per year. The table below shows the increase in installed capacity and production during the years 1946-51 :

(Monthly average on calendar months)			
Year		Installed Capacity	Production
1946	...	56	39
1947	...	177	57
1948	...	333	85
1949	...	383	173
1950	...	442	383
1951	...	442	604

(Source : Directorate of Industrial Statistics)

The situation in recent years is summarized below :

Year		Number of factories	Capacity	Production
1952	...	6	6,324	4,350
1953	...	8	—	3,716
1954	...	12	14,700	8,652

The four extra units which came into existence in 1954 meant an investment of Rs 1,64,94,000 of which less than 10 per cent was foreign.

The figures show, *inter alia*, the ratio between actual output and productive capacity in the last few years. The violent fluctuations in production have made it difficult to keep all the available machinery in effective use, and output below capacity has been reflected in cost. A section of the industry questions the wisdom of building up, as is contemplated, additional productive capacity without sufficiently allowing for existing unused capacity.

The engines are manufactured to British Standard Specifications. The product is technically and commercially acceptable. While there are regrettable exceptions, broadly speaking the standards achieved in India, according to expert opinion, augur well.

There was an upward trend in imports during 1951.

There are also indirect imports. Calculation of their value is far from easy, as it is incorporated in the cost of many different items of imported equipment and the value of the engine itself is not separately shown in trade accounts.

Sources of supply have been, in the main, Britain, Europe and Japan.

In prices, there is no great difference between Indian and imported engines. Indeed the problem of price, although important, has been less difficult than that of finding buyers.

In the planned economic development of India, diesel engines have a very important part to play as an aid to power generation for transport, agriculture and industry. In the order of priorities laid down in the draft First Five-Year Plan, producer goods industries came next only to defence industries. In determining how the limited resources available for industrial expansion should be applied, the Planning Commission recommended that the demands which schemes for agricultural development and expansion of irrigation and power would make on industrial products should be satisfied. In the revised Plan it was stated : 'Expansion of capacity in industries which produce capital goods and producer goods is necessary, firstly, in order to meet the additional demands on them on account of the development of agriculture, irrigation and electricity during the period of the Plan, and, secondly, for establishing a better balance in the industrial structure . . . Industries manufacturing agricultural implements, diesel engines and pumps have a direct bearing on improvement of productivity in agriculture and there is scope for further development in this field . . . Special efforts are necessary for assisting industries manufacturing sheetglass, diesel engines, etc.'

The Government of India is endeavouring to expand production. Seven schemes have been drawn up for the manufacture of diesel engines and when they mature the productive capacity of the industry will be raised in the aggregate by 18,600 engines per annum. These schemes incorporate technical assistance from some foreign firms who are experienced, established and reputed manufacturers in the line. A gap in the structure of the industry—the manufacture of fuel-injection equipment—has recently been filled. A unit with an annual capacity of 4,500 pumps went into production in June 1954. Steps are being taken to establish plant for the manufacture of 40,000 per year.

A rated capacity of 55,620 and production per year of 50,060 engines is the target fixed by the Planning Commission for 1955-6. It represents an addition to present capacity of about 41,000 engines and to present rate of production of about 41,400. The target assumes a considerable widening of the market. It is not known whether competition from the increasing use of electric power has been taken into account.

The present aim is to consolidate the success achieved so far. The industry will certainly benefit from the expansion of production as a

whole. A substantial home market provides reasonable stability for the industry. The recent recession in production seems a temporary phase—largely the result of accumulation of stocks. Present indications are that the Planning Commission's expectations will be fulfilled.

CHAPTER V

THE LIGHT MECHANICAL ENGINEERING INDUSTRIES

LARGE industries are usually in the limelight. Less is heard of the several small ones, whose collective, if not individual, contribution to general industrial progress has been considerable. Light mechanical engineering industries are not easy to assess in terms of economic value, for some of them produce only 'intermediate' products and are hence comparatively self-effacing. But that they have played a significant part in the expansion and intensification of Indian industry there is little doubt. For instance, on them several primary industries have been dependent for the facilities that allow them to function at all.

This is an attempt to assess the situation of some of the important light mechanical engineering industries in terms of production, imports and exports and to deduce from such statistics as are available future demand. Data are somewhat scarce. What is available is useful in a restricted field but insufficient to give a general picture. Five industries—small tools, machine tools, hurricane lanterns, sewing machines and bicycles—have been selected for special mention. The selection does not connote any technical bias. Rather they represent the 'line of least resistance', for regular monthly statistics are available in much more detail for these sections than for others.

For an approximate assessment of the position, recourse has been had to the reports of the Tariff Board, the Directorate of Industrial Statistics, Accounts Relating to the Foreign Sea and Airborne Trade, discussions with representatives of the industries and manufacturers' associations. All this notwithstanding, it has been possible to obtain only a general indication of the direction development is taking.

It will be seen that from being a small and rather neglected sector, light mechanical engineering industries are projecting themselves on Indian economy if not on a spectacular scale, yet on a fairly widespread basis, and provide a substantial volume of employment. It will also be apparent that although India can continue to depend upon Western European countries, especially Britain, for her essential needs in these, the development of local resources calls for special attention. To this task many factories are addressing themselves. They are intensifying their output for Indian, and in some cases oversea, markets; and should an emergency arise, production could easily be diverted to defence purposes. In these developments may be found good grounds for a reasonable optimism.

Small Tools

The term 'small tools' comprises a large variety of tools in general use, including hand tools.

Though rather different, the role of small tools in this era of industrial efficiency is quite as important as that of machine tools. Indeed there is a section of opinion which holds that instead of embarking on large projects which make heavy demands on the still restricted capital, technical and managerial resources available, industrial policy should be confined in the immediate future to the promotion of critically small industries which would contribute to the spread of industrial technique as a basis for later growth.

Production before the war was negligible—about 10 per cent of requirements, which were met mostly by imports. The industry may be said to have started with the establishment of a factory in Bombay in 1937 by the Indian Tool Manufacturers Ltd., to manufacture twist drills, reamers, cutters and certain other small tools. Wartime orders to meet the requirements of railways, port trusts, ordnance factories, public utility concerns and engineering firms led to rapid expansion; practically the entire production of the Indian factories was taken up. When, with the coming of peace, orders for war requirements stopped, some of the smaller firms had to close down. Competition from imports increased. In aggravation, as the result of the disposal of army surpluses, large stocks of small tools were in the market. A large part of the demand was met by drawing upon the accumulation of wartime stocks. The case was referred to the Tariff Board in 1949. The Board reported that the industry was fairly well established and that it was conducted on sound business lines. It recommended that protection should not be granted by raising import duties, but in the form of restricted imports and reduction in the duty on imports of special steel—an essential raw material. The Government accepted the recommendation. Tariff protection was extended to the manufacture of alloy, tool and special steels. Quantitative restrictions were also imposed on certain small tools. Manufacturers were permitted to import special steels at concessional rates of duty. In several cases, preference was given for Indian goods in purchases on Government account.

The more important producing units are in Bombay, Calcutta and Hyderabad.

Raw Materials

The raw materials required for production are high-speed steel for cutting tools; other alloy and tool steels for precision and measuring

tools ; carbon steel for certain kinds of cutting tools, precision and measuring tools ; pig-iron and coke for certain kinds of machine tool appliances ; furnace oil and certain hardening oils.

The industry requires for full production now 25.0 tons of high speed steel, 27.5 tons of alloy steel and 25.0 tons of carbon tool steel. All this has to be imported. To tide over possible emergencies, stockpiling of alloy steels is under consideration.

Reporting in 1949, the Tariff Board stated : 'The main raw material being high-speed steel, the industry cannot hope to carry on successfully without State assistance until this raw material is manufactured in this country in sufficient quantities and is made available at a reasonably low cost.' 'Judged by the present conditions,' the Board added, 'it is likely that imports will have to continue for some years to a small extent.'

The supply of high-speed, alloy and tool steels seems to be the main obstacle to progress. It is hoped, however, that as a result of the steps taken by the Government to implement the recommendation of the Tariff Board in its report on the continuance of protection to the alloy, tool and special steels industry, there will be a substantial increase in the production of these types of steel.

Of the other raw materials, pig-iron and coke are available in India in adequate quantities, and supplies of furnace oil and hardening oils have been satisfactory. Imports of machinery are mostly from the U.K.

Production

This is an industry of small firms in which craftsmanship is a general feature. During the last three years it has emerged as a separate, identifiable entity. Several new firms have come into being for the manufacture of twist drills, reamers, cutters, taps, dies, hobs, steel files and fret and piercing saws. From producing a few items to the specifications of the buyer, the industry has advanced to the manufacture of a wide range of equipment for the engineer, who is perhaps the most meticulous and exacting customer in the world.

According to the Development Wing of the Ministry of Commerce and Industry, items now being manufactured in India are : twist drills ; hand-machine, bridge shell and chucking reamers ; milling cutters ; taps, dies ; knurls and knurling tools ; tools for press work ; shear blades ; lathe tools (including butt-welded) ; wood-working cutters ; fret and piercing saws ; tap wrenches and die stock ; bench, pipe and machine vices ; steel files ; precision testing and measuring tools such as V blocks, parallel clamps, Vernier callipers, angle blocks, C.I. blocks, surface plates, straight edges, knife edges, surface gauges, hermaphrodite callipers, firm joint callipers (inside and outside), sine

blocks, steel parallels and steel rules 4" × 6"; plug gauges, plain and threaded and cap gauges, go and no go; wire-drawing diamond dies; diamond glaziers; emery wheel dressers; spanners and socket wrenches; hammers; screwdrivers; carpenters' braces; carpenters' chisels; cold chisels; carpenters' cramps; hacksaw frames; counter sinks; iron planes; screw augers; gimlets; adzes; gauges; anvils; snaps; top and bottom fullers; and miscellaneous carpenters' and blacksmiths' tools.

The table below shows current capacity and progress in the production of the more important items during the years 1949-52. Comparisons over a longer period are liable to wide margins of error, for reliable statistics are not readily available; and such that can be had reflect a whole mass of complex movements.

Item	Installed Capacity	1949	Production		1952
			1950	1951	
Twist Drills (numbers)	14,82,000	4,01,204	4,44,715	10,26,685	7,73,242
Reamers (numbers)	67,200	11,304	6,847	11,933	13,142
Milling Cutters (numbers)	45,000	2,364	1,287	5,407	7,208
Taps (Numbers)	3,14,000	324	540	8,085	16,257
Dies (numbers)	8,400	—	—	659	105
Steel Files (dozens)	50,000	—	—	8,297	6,958

Later production figures for each item are not readily available. The situation, however, may be summarized as follows :

	Year	Accounting Unit	Number of Factories	Capacity	Production
Small tools (twist, drills, reamers, cutters, taps and dies and files)	1952	Numbers	8	24,60,700	8,93,350
	1953	Numbers	8	27,56,600	5,14,160 (Estimated)

(Source : Ministry of Commerce and Industry)

Manufacture of all the above, except files, is adequate to meet the entire domestic demand. And with the continuing restrictions on imports, factories are increasing and diversifying production. New items are being gradually taken up for manufacture.

It will be seen that generally the industries are doing well ; but not all equally so. In view of the industry's wide ramifications and its interdependence on so many other manufacturing activities, this is not surprising. It would be unreasonable to expect conditions to be otherwise. And perhaps it is fortunate for the stability of the industry that it is so broadly based ; it can ride local depressions.

Imports

Imports of implements and tools, other than agricultural implements and machine tools, in recent years have cost :

1951-2	1952-3	1953-4
Rs	Rs	Rs
1,99,54,320	1,14,93,678	1,15,47,006

The decline reflects in some measure the extent of increase in Indian production.

The list below shows the items for which increased facilities for imports from hard currency areas have recently been provided :

Item	Existing Import Policy	Revised Import Policy	Remarks
(1) Files and rasps, emery wheel dressers, glass cutting or writing diamond tools	15 per cent General 40 per cent Soft	25 per cent General 40 per cent Soft	
(2) (a) Adjustable hand reamers or expanding reamers (b) Twist drills and reamers less than 3/64" dia. (c) Carbide tipped drills and reamers	100 per cent Soft	100 per cent Soft	Up to 50 per cent of the face value of quota licences can be utilized on the dollar area.

The Tariff Commission has taken up for investigation the claim of the steel files industry to protection or other forms of State assistance.

Current demand for the more important items is estimated as follows :

Twist Drills	Numbers	5,00,000
Reamers	"	30,000
Milling Cutters	"	45,000
Steel Files	Dozens	4,00,000

And this is expected to grow, for Indian industry is expanding and there is much capital work on the national level.

Indian goods have won their way into the market. The consumer

seems at last convinced that the correct raw materials are being used and that manufacture is according to international standards of accuracy. Tests at the Government Test House and Laboratories have shown that the Indian product is comparable to the imported except for tools which require special equipment; and experience has confirmed this verdict. Government railway workshops, ordnance factories and big engineering establishments have reported favourably.

The industry produces a large variety of small tools which have reached a high degree of precision. Yet there is scope for improvement. The suggestion of the Tariff Board (1949) seems most sound. It was : 'Considerable improvement in quality and acceleration of production can be achieved if each factory specializes in the production of particular types of tools for which its plant is best equipped.'

Machine Tools

Only during relatively recent years has Indian industry become generally 'instrument conscious'. Till then, it was dependent largely on the human element. Possible applications of instrumentation in industry are practically unlimited. 'Machine tool' is a generic term which covers a wide range of articles and an enormous variety of designs. There are many definitions, but broadly speaking it can be taken 'to include any mechanical contrivance for cutting, forming, abrading, polishing or otherwise working or treating wood, glass, metal, or plastic material such as bakelite, any standard equipment usually sold therewith and any machinery ancillary to the operation thereof'.

Machine tools are usually power-driven and are not portable by hand. Divided into types, they are, again broadly speaking, lathes, drilling machines, shaping machines, planing machines, milling machines, band-sawing machines, circular sawing machines, presses and chucks.

They have a large variety of uses for both general and special purposes. Among the more important are the construction of machinery and parts and the maintenance and repair of plant. They have been called 'producer goods in the second degree' because they constitute the productive element 'directly responsible for manufacturing the machines which assist in producing goods for consumption'.

Apart from the steady encroachment which they have made into uses formerly reserved for small tools, they are an integral, and, in some cases, a fairly expensive, part of the set-up of most industries, e.g. automobiles, aircraft and agricultural implements. Not only do they confer the obvious benefits of increased control, but machine tool factories administer a stimulus to the engineering industries of the area

in which they are located. Invaluable in peace time in maintaining an expanding industry, during war they lend themselves readily to conversion of production to war requirements. The rapid growth of the industry and its present position in Western countries imply early recognition of this fact. Many countries, especially the U.S.A., are constantly experimenting with new and improved types of machine tools—more elaborate and more expensive.

There is in India evidence of effort to produce machine tools as early as 1890. Manufacture appears to have continued throughout the early years of this century. But manufacturers were few, and their products were generally poor in quality. Production was mostly by factory and workshop owners to meet their own requirements. Indeed it may be said that an organized machine tool industry did not exist before World War II. Requirements were met mostly by imports.

With the outbreak of war, imports became difficult, and the Government of India decided to develop the industry. In February 1941, it passed the Machine Tool Control Order and appointed a Controller to make an inventory of machine tool production, regulate imports, improve the quality of the local product and secure for the armed forces, ordnance factories and war industries machine tools of the best quality.

Imports were strictly controlled and licences were issued only for high-priority jobs and for such machine tools as could not be manufactured here. Imports were subject to a revenue duty of 10 per cent *ad valorem*. Further, the Machine Tool Controller allowed a margin up to 25 per cent in favour of home products. Thus manufacturers virtually received protection amounting to about 35 per cent.

The productive capacity of leading manufacturers was extended by the supply of high-quality machine tools for balancing or expanding their production. Licensing of imports of machinery, however, was limited to those who had a fair chance of success, and they were required to confine themselves to the production of those types of machine tools for which they had the equipment.

To further the scheme of expansion, the services of a team of seven technicians with long experience in manufacturing machine tools were obtained from the U.K. to guide Indian manufacturers. These stayed for about two and a half years and were of much help in raising quality. The Government offered the services of the Machine Tool (Inspectors) Branch to test and inspect the machine tools manufactured. This too helped to improve quality.

Schemes were put into force to regulate and control more strictly the distribution of machine tools manufactured. The Government agreed

to purchase the entire production of the firms sponsored, provided they came up to the required standards.

As a result of these measures, by 1946 the industry had made good progress. As against only 273 machine tools (graded) manufactured in 1942, production in 1945 had reached 3,699 machine tools (graded) valued at about Rs 1.11 crores. It may therefore safely be said that the growth of the industry in India was almost entirely due to the war.

Soon after the war, the industry suffered a serious setback. Along with the abatement of the war demand, came a liberalization of import policy which placed on the market cheaper and better products. And, in aggravation, large quantities of army surplus stores were in the market. Offtake fell to disastrous levels. Indeed, a number of the smaller manufacturers were constrained to suspend operations. And the bigger ones were accumulating stocks. The industry's case for protection was considered by the Tariff Board in 1947.

The Board recommended that the industry should be protected up to 31 March 1950 ; that, subject to certain exceptions, a protective duty of 25 per cent *ad valorem* should be imposed on all imported machine tools ; that this rate of duty should remain in force for one year, during which the Machine Tool Controller should collect, as far as possible, information regarding c.i.f. prices of those qualities which were manufactured in India ; that if, during the period of protection, any attempts were made by exporting countries to dump their products in the Indian market, a review should be made and the protective duty adjusted accordingly ; that import control on a quantitative basis should continue up to 31 March 1950 ; that licenses for imports should be issued only in respect of machine tools not manufactured in India or not manufactured in sufficient quantity to meet the full demand within a reasonable period of time ; that for machine tools not manufactured in India a remission of 15 per cent duty should be made, thus reducing the effective duty to the present level of 10 per cent *ad valorem* ; that all Government and quasi-Government purchases should be of Indian-made goods as far as possible ; that the Government should create a special fund for the development of the machine tools industry and make an annual non-lapsable contribution of Rs 10 lakhs to this fund ; and that an advisory committee consisting of representatives of manufacturers, importers and main consumers should be set up and maintain close touch with the various schemes of development and control.

The Government accepted the recommendation regarding the quantitative control on imports and purchases of Indian machines by Government departments. In regard to the levy of a protective duty and the establishment of a special fund, the Government stated that it was considering other means of assistance and suggested grant of a

suitable subsidy. The industry was asked to send proposals. Representatives of the industry drew up a scheme in December 1948. It covered payments by the Government of :

(a) *Ex gratia* sums for development expenses for the manufacture of better and new types of machine tools ;

(b) Returnable loans for purchase of balancing plant and equipment ;

(c) *Ex gratia* rebate of 20 per cent to producers of Grade I machine tools with a view to lowering sales prices to that extent and bringing them within the purchasing power of Indian consumers.

Further, the industry proposed as a measure of relief to the Government that the subsidy should be paid for by increasing the import duty from 10 per cent to 15 per cent, as against the increase from 10 per cent to 25 per cent recommended by the Tariff Board. After discussions between the Government and representatives of the industry, the scheme was rejected. The import duty, instead of being increased from 10 per cent to 25 per cent as recommended by the Tariff Board, was reduced to 5 per cent.

Exports of pig-iron were stopped and larger releases of steel, pig-iron, coal or coke were made to Grade I firms. Manufacturers were encouraged to produce better and up-to-date models, for which there was increasing demand, as a result of which some firms now manufacture 'heavy duty all-gear head lathes and all-electric shaping machines'.

The Conference on Industrial Development held in December 1947 thought that the strengthening of the machine tools industry and its establishment on a firm footing should come under a short-term plan and that expansion, including the manufacture of a wide range of production types of modern machine tools, was essentially a long-term plan. For the short-term—which was taken to be three years—the target was fixed at 15,000 units and for the long-term, at 50,000 units.

Basing its views on the report of its Departmental Committee on Engineering Industries, it recommended the short-term rationalization of machine tool production to determine the particular types and ranges to be manufactured individually by each leading manufacturer ; subsidizing manufacturers to meet the heavy cost of jigs, tools and fixtures to produce correct types of machine tools ; the provision of balancing plant from reparations or by imports ; assistance from foreign technicians and Government inspection organizations ; the preparation of specifications for raw materials required ; and an increase in the supply of pig-iron, steel and other raw materials.

Structure

Manufacture is fairly widespread. There is a heavy concentration of

producers of ungraded machine tools in the northern zone. The more important units are in Calcutta, Bombay, Punjab (I) and Mysore State. This regional location has had advantages in marketing.

In 1945, the Machine Tool Controller reported that altogether 186 Indian firms then held manufacturing licenses for machine tools and ancillary equipment, distribution being: North, 127; East, 30; South, 12 and West, 17. In 1947 firms were re-graded. Producers were divided into three grades according to the quality of tools produced. Those firms for which no grading was thought necessary were called 'ungraded'. A census in 1947 showed that there were then in India 22 firms distributed as follows:

	Grade I	Grade II	Grade III	Total
Bengal	4	3	1	8
Bombay	3	1	1	5
Mysore	1	—	—	1
Punjab (I)	4	2	2	8
	—	—	—	—
	12	6	4	22
	—	—	—	—

In addition, there were about 100 ungraded firms. The value of graded machine tools at the time of peak production amounted to nearly 10 million rupees.

Partition deprived India of the capacity of about 6 graded and 50 ungraded firms in the Punjab. An official report in September 1951 stated that there were then about 16 graded and about 50 ungraded firms, and that the annual value of graded machine tools manufactured by them had dropped to below Rs 40 lakhs.

Since the war, a number of manufacturers of ungraded machines either went out of production or changed over to new lines as a result of competition, while others succeeded in improving quality and thus moved from a lower to a higher grade. Of the 121 firms now in operation, 16 are graded firms having machines worth about a crore and a quarter of rupees, and the rest are ungraded units spread all over the country. Of the 16 graded firms, the manufacture in 14 conforms to internationally recognized (Schlesinger) standards. Their combined rated capacity is estimated at 3,000 machine tools per annum, valued at about Rs 90 lakhs. The 105 ungraded firms are not solely engaged in the manufacture of machine tools. Their activities extend to other industries. Factory layout, in most cases, is technically not flawless.

Raw Materials

The principal raw materials required are pig-iron, rolled steel products, non-ferrous metals, coal, coke, limestone and timber. About 2,500 tons (Rs 3 lakhs worth) of pig-iron and about 800 tons (Rs 3 lakhs worth) of mild steel are required annually for the industry to work to full capacity. All the heavy raw materials required are available in India, but supply seems to have been irregular and inadequate. In 1947 the industry complained of—indeed attributed the fall in production to—the shortage of steel, pig-iron, coke and coal. There were protests against the export of pig-iron from India on the ground that urgent indigenous needs had not been met, and somewhat pointed references to the high inland prices of pig-iron as compared with the export price. The export of pig-iron was stopped.

Although there has been some improvement, shortages persist. The supply of pig-iron and steel is under control. Distribution is made by the Iron and Steel Controller. But the industry is much exercised over the increasing scarcity of pig-iron.

Another handicap is the necessity to import some semi-fabricated and finished materials not available in India.

Capital and Equipment

Capital invested in the machine tool (graded) industry is estimated at Rs 90 lakhs.

After the war, some companies ordered balancing plant. There was a progressive addition of supplementary equipment. Even so, the Tariff Board reported in 1947 that for some years to come the productive capacity would be adequate to supply only a part of requirements and that it would be necessary to import a fairly large number of machine tools, especially of the more elaborate and recent designs. Most manufacturers lack up-to-date plant and equipment. Its purchase would mean heavy initial outlay—an expenditure which few in the industry can incur.

The Tariff Board recommended that the Central Board of Revenue should examine sympathetically the request of the industry to be permitted to write down depreciation at a higher rate than at present. This is particularly necessary because balancing plant is expensive and there is no immediate return on the capital invested. India needs to have access at minimum cost to the most modern machines produced anywhere in the world—a need not easily met. The State can do much in finding the market. Inclusion in trade agreements is a possibility.

Labour

In regard to personnel, the Tariff Board (1947) recommended that

the Government should take every step to import competent specialists with the least possible delay and that they should be allocated to different manufacturers to render technical advice and guidance.

Since the industry is very specialized, skilled labour is essential. Scarcity has been aggravated by the tendency among labour to drift. Experience in machine tool manufacture makes a workman useful in many other industries. Countering this roving disposition would call for much inducement in the form of higher wages and more amenities than those available elsewhere, involving expenditure which the industry in its present state can scarcely afford. Till labour becomes conscious of the advantages of specialization, the machine tool industry may have to be content with being only a training ground. Until recently, the directions in which plant could compete with labour on the grounds of cost were limited. Now, however, with labour productivity not yet back to pre-war standards and its cost very much greater, producers feel that the only way to stabilize rising costs is by the employment of machines to reduce as much as possible the number of man-hours. This process will perhaps continue, all its social and political implications notwithstanding; and it may result in the substitution ultimately of a large body of ill paid and unskilled labour by a small group of highly skilled and well paid plant operators and technicians.

Production

The table shows production during the years 1942-9 :

Year	Quantity	Value in Rs	Production viewed as percentage of imports
1942	... 273	6,07,000	10.65
1943	... 1,713	63,58,000	118.48
1944	... 2,170	77,80,000	50.95
1945	... 3,699	1,11,66,000	61.35
1946	... 2,120	91,25,000	49.79
1947	... 1,400	45,87,000	12.47
1948	... 1,691	54,72,000	13.20
1949	... 2,240	47,29,000	11.27

The fall in production after 1946 was variously explained. Among causes widely mentioned were that by 1948 about 2,000 machines had arrived as reparations from Germany; that the Government, to save

foreign exchange, met most of its demands from such reparations stocks ; that surplus stocks were released to industrial consumers at low prices ; that prejudice against the Indian product continued ; that although Government had accepted the recommendation of the Tariff Board as to quantitative control on imports, considerable delay had occurred in implementing this recommendation with the result that large stocks had come in from abroad ; that the Government's acceptance of the Board's recommendation as to purchases of Indian machines by Government departments had been only nominal and that the reduced capital development programmes in the country and the Government project for establishing a machine tool factory of its own were hardly likely to encourage increased production. There was also mention of shortage of essential raw materials, electric power, coal, transport facilities and balancing plant.

During the war, only very primary and simple types of machines such as bench lathes, bench drilling machines, vertical-pillar type drilling machines, shaping machines, power presses and four-jaw lathe chucks were being produced. In the years immediately after the war, a trend towards the use of better materials (such as modern alloy steels) and towards greater weight was discernible. This resulted in both speed and an enormous increase in feeds. Machine tools with a far wider range of speed and finer feeds than were possible a few years ago were manufactured in India. Among the advantages claimed for these the chief ones are : ease of operation ; saving in skilled labour ; larger output ; and a higher degree of accuracy. More recently, the manufacture of motorized 7" and 8½" all-gearred head lathes has been established. Tested, these machines have been found satisfactory. Several Government departments have since received supplies.

Subjoined is a summary of imports and production during the years 1950-2 :

Year.	Annual Imports Value in Rs	Annual production in India of graded machine tools		Percentage pro- duction of graded machine tools to imported machine tools
		Quantity	Value in Rs	
1950	2,49,00,805	1,120	29,59,000	10.67
1951	2,50,00,000	2,720	45,45,000	18.18
1952	3,34,44,687	4,488	44,37,377	13.30

(Source : Development Wing, Ministry of Commerce & Industry)

Virtually, this is also the estimate which the Secretariat of the Ministry has reached ; only they are able to produce figures for 1953 as well. According to the Secretariat, installed capacity and production in the years 1952-4 were :

Year	No. of Units	Capacity (Value in Rs)	Production (Value in Rs)
1952	17	10,00,00,000	44,37,377
1953	16	1,35,80,760	44,66,789
1954	16	1,36,00,000	50,00,000 (Estimated)

What these figures do not show, however, is the minor revolution, referred to earlier, that has taken place in the variety of types and designs of goods produced by Indian manufacturers. There is one more particular cause for satisfaction. A readier supply of raw materials has eased the pressure on the industry's economy.

According to the Development Wing of the Ministry of Commerce and Industry, manufacture in India now includes the following : bench lathes, $4\frac{1}{2}$ " centre ; cone-pulley type lathes up to 13" centre ; bench drilling machines $\frac{1}{2}$ " capacity ; vertical-pillar type drilling machines, cone-pulley and motorized, up to 2" capacity ; shaping machines up to 24" stroke ; slotting machines up to 7" stroke ; planing machines, $6' \times 3' \times 3'$; hack-sawing machines up to 9" capacity ; double ended tool grinders ; power presses up to 60 tons capacity ; machine vices up to 6" jaw width ; three-jaw and four-jaw lathe chucks up to 12" and 24" capacity respectively ; all-gear head lathes up to $8\frac{1}{2}$ " centre ; hydraulic shaping machines, 18" stroke ; shearing machines up to $4' \times \frac{1}{8}$; drill chucks up to $\frac{3}{4}$ " capacity ; wood thickness planers, 12" size ; universal milling machines, size $31\frac{1}{2}" \times 9\frac{1}{2}"$; bolt threading machines up to $2\frac{1}{2}$ " diameter ; and accessories of machines like centres, sleeves, collets, etc., all sizes. Instances of plant developed to meet new technical requirements are constantly occurring ; and companies are planning increases in output.

Imports have been a changing picture. Seen over a period of years, however, they suggest a decline. For instance, in 1950-1 they amounted, in value, to Rs 265.3 lakhs ; and by 1953-4 they had fallen to Rs 199.3 lakhs.

On the basis of existing statistical information it is not possible to calculate the dependence of various industries on imports taking into account both their direct and indirect use of imported materials. All that can be said with safety is that current needs are considerable and that, owing to relaxation of import restrictions and the need for replenishment of stocks with expanding industrial activity, imports, despite uncertain price movements, are likely to continue for some time yet on a fairly heavy scale. The level of effective demand is still much higher than productive capacity.

In addition to normal imports, aid has come under the Colombo Plan

Some £ 35,000 (nearly Rs 4,70,000) worth of machine tools of the most modern design are being provided by the British Government for the tool-room of the Indian Institute of Technology at Kharagpur. The equipment includes milling, shaping, drilling and grinding machines, lathes, lapping machines, and sawing and filing equipment. And accompanying the equipment is expert advice in installation and in the training of Indian technicians.

'In order to improve the quality and design of the indigenous products, lower their cost of production and extend the range to modern types of machine tools, it is essential,' according to the Planning Commission, 'for the existing manufacturers to undertake schemes for rationalization as early as possible.' 'Besides improving the layouts of the factories and securing certain essential equipment, raw materials and the services of specialized technical personnel, the existing manufacturers should also,' adds the Commission, 'combine among themselves and set up an extensive sales organization and an efficient technical sales service.' 'In the meanwhile, the existing manufacturers should also,' the Commission continues, 'raise their production speedily so as to meet the future estimated demand of a little over 3,000 machine tools by the end of the next five years.' Another important recommendation is that the Government 'should help the industry by facilitating adequate and regular supply of the essential raw materials.'

In the future, the prime question of policy seems to be how the gains made in internal flexibility can be consolidated. In other words, how large a total expansion can we reasonably hope for within the next few years. An estimate, necessarily approximate, made by the Planning Commission, is given below :

	Nos.	1950-1	1955-6
Number of factories	...	14	15
Annual rated capacity	...	3,000	4,600
Production	...	*1,101	4,600

*The estimated figure relates to the calendar year 1950.

Demand

In 1952, the Planning Commission estimated the maximum demand for the precision and production type of machine tools at about 1,500 per annum, valued at about Rs 4 crores. The present annual demand, in terms of monetary value, is assessed at Rs 10 crores.

Only during the last few years, as a result of the restrictions on imports, has there been a revival of demand for the Indian product. In response, a few of the more important manufacturers are trying to improve, increase and diversify output. Increase in demand seems

inevitable. Better, more, and if possible cheaper, machine tools will be required to put through the several State projects and the expansion schemes in both the public and private sectors of industry. It was estimated that requirements would rise to nearly Rs 100 lakhs (about 3,330 machine tools) by the end of 1955-6.

State Factory

The manufacture of machine tools may be considered under two headings : the private sector and the public sector. The first has already been discussed. In the second, work on a Government factory (Hindustan Machine Tools Ltd.) commenced towards the end of 1947 and two leading foreign machine tool manufacturers—the United Machine Tool Factories National Corporation, Prague and the Oerlikon Machine Tool Works, Buehrle & Co., Zurich—were consulted. Representatives and technical experts of both the firms visited India and, after a careful survey, submitted proposals for technical assistance in establishing an up-to-date factory to meet the needs of the country. After careful consideration the Government of India accepted the Swiss firm's offer and entered into an agreement with that company in April 1949. Besides obtaining for India technical 'know-how', experts, and equipment, the agreement envisages the manufacture of 900 high-speed lathes, 460 milling machines and 240 heavy-duty drilling machines per year. A gear-cutting shop and a foundry were included in the project programme.

The Government accepted the Oerlikon Company's recommendations to locate the factory in Mysore State. Jalahalli (near Bangalore) was selected as the site. The Government of Mysore made available the land required for the factory. The Oerlikon Company was authorized to place orders for plant and machinery immediately required to the extent of 5 million Swiss francs. Key technical personnel were recruited. The estimated capital cost of the scheme was about Rs 8.37 crores. The annual value of the output of the factory, when in full production in 1955-6, was estimated at over Rs 4 crores.

Judging from the latest reports of the Development Wing and the Ministry of Production, progress has not been altogether satisfactory. Surveys showed a marked change in the pattern of demand. The original time schedule of the Hindustan Machine Tools Factory had to be revised 'to incorporate the latest developments and improvements in the design of the lathe.' These, in turn, necessitated considerable adjustment in the layout of the factory. And there was the need to co-ordinate the plans for the State factory with developments in the private sector. The first prototype of the lathe is under manufacture, and will be tested in Switzerland. Soon after the test, the manufacture of some components is expected to commence. In the

initial stages, it was proposed to confine production to the manufacture of 400 high-speed lathes of 8½" centre. Capacity exists to increase the production of high-speed lathes, milling machines, heavy-duty drilling machines, etc. without any great increase in capital cost, and the plant is capable of being diverted to the production of other tools. As against only Rs 50 lakhs in 1953-4, provision was made in 1954-5 for an advance of Rs 2 crores to the factory as share capital. Accommodation for technical offices, stores, laboratory and ancillary equipment is under construction, and is expected to be completed shortly. Some of the foreign expert technicians recruited are already at the factory; others are expected soon. They are to assist in production as well as in the training of Indian personnel. Five Indians are now undergoing an intensive course of training at Oerlikons Machine Tool Factory in Switzerland.

The Planning Commission has recommended that 'in view of the national and strategic importance of the machine tool industry and the facilities available for its development, the State project to manufacture the modern type of precision and production machine tools suitable for heavy mechanical industries should be implemented.'

This is a fundamental development, in which the influences of India's post-war industrial policy and international technical co-operation are intermingled. Happily it has not required the imminence of another war to stimulate a realization of the serious plight to which the country would without doubt be reduced by the continued insufficiency of its home resources.

Although assurances have been given that the factory is planned to produce machine tools of heavier and complicated types, and that its products will not, therefore, offer unfair competition, the industry seems unable to divest itself of the suspicion that the Government is not very enthusiastic towards private enterprise.

Hurricane Lanterns

It is, however, to the hurricane lantern sector that we must turn for evidence of significant progress.

The industry may be said to have started in India in 1925, when the Ogale Glass Works Ltd. opened a metal section in their glass factory at Ogalewadi in Aundh State (Bombay), for the manufacture of lanterns. Second in the field were the Oriental Metal Industries Ltd., Calcutta, which commenced production in 1936. World War II affected the industry in two ways. Part of existing capacity had to be diverted to meet defence needs. The scarcity of imports proved a stimulus to expansion. By and large, the industry benefited from the war, and has

since expanded. The Government, through its Development Wing, helped to accelerate and widen this expansion. The industry is now able to meet in full the country's requirements. Progress in the last few years has been particularly rapid.

In 1946 there were about eight important manufacturers, and their total capacity was estimated at 17.52 lakh lanterns per annum. Production that year was about 4.7 lakhs. By 1949, according to an estimate by the representatives of the industry, installed capacity had increased to 25 lakhs and was expected to increase further as four to five new units had just commenced production and some of the old units had installed improved types of machinery.

Raw Materials

Materials required are tinplates (or mild steel sheets), brass sheets, galvanized and steel wires, solder, paint, wick and glass globes. The Tariff Board (1946) suggested that manufacturers should form an association and approach the Government for assistance in the procurement of raw materials to enable productive capacity to be used to the full. The Tariff Board (1949) recommended that the Ministry of Industry and Supply should take steps to supply block tin to the industry in sufficient quantities.

Mostly Indian tinplate is used. Supplies are regular but not adequate. The Ministry of Commerce and Industry is willing and able to supply block tin ; but the cost, manufacturers complain, is much too high.

Of components, there are about 36. Manufacture, although it involves between 120 and 140 operations, does not require complicated machinery.

Most of the machinery comes from the U.K., the U.S.A. and Europe. The Tariff Board (1946) recommended that the Government should refund duty paid on machinery which might be imported to develop the industry and that facilities should be given to import it from any country including the U.S.A. As part of their anti-inflationary measures, the Government reduced the customs duty on imported machinery from 10 per cent with effect from 23 October 1948.

The total capital invested in the industry, inclusive of investment for the manufacture of certain other goods, is estimated at Rs 50.0 lakhs.

Workers number about 3,000. One of the larger units reports increase in productivity. And, generally, the expansion of operations has absorbed labour rendered surplus by rationalization.

Production

The table below shows progress during the years 1947-50 :

		1947	1948
No. of units	...	6	6
Capacity	...	1,000,000	1,300,000
Production	...	910,071	973,599
		1949	1950
No. of units	...	9	11
Capacity	...	1,890,000	3,600,000
Production	...	1,728,036	2,805,899

Manufacturers complained that production might have been greater but for difficulty in obtaining raw materials, particularly tinplate which has had to be imported to make up the deficiency in home production.

Progress in production in three recent years is summarized below :

	No. of Factories	Capacity (Single-shift)	Production
1951	—	42,60,000	39,76,800
1952	12	44,10,000	35,22,973
1953	13	45,82,800	43,12,382
1954	13	45,82,800	49,87,009

(Source : Ministry of Commerce and Industry)

Several units worked two shifts in 1954. Assessment of the position, a few years ago, showed that a gradual development of the industry was desirable. The table below gives a broad picture of the programme to which the industry is working :

		1950-1	1955-6
Major units	No. of Units	11	13
Installed capacity (on a single-shift basis)	Millions	4.3	4.5
Production	...	3.2	6.0
Exports	...	Negligible	1.0

The capital necessary has already been invested. No further expansion of the industry is contemplated. Should demand still exceed supply, as seems probable (demand in 1955-6 is estimated at 6,000,000), it is proposed to meet it by operating for more than one shift rather than through the establishment of new units.

About the quality of the product, opinions differ. There is the view

that although there has been some improvement, there is considerable scope for more ; others contend that the quality is as good as that of imported lanterns. (The references are invariably to Japanese and Hong Kong lanterns.) But all are agreed that with regular and adequate supply of the raw materials required further improvement in quality should not be difficult.

Some manufacturers have had their products tested at the Government Alipore Test House ; the results are said to be satisfactory. Also of possible future significance are the tests which a few manufacturers are conducting in their own workshops. Usually these relate to security against leakage and 'extent of burning power', i.e. the time taken for one fill of kerosene to burn out. The more enterprising have begun producing electroplated lanterns and lanterns of sizes other than the standard.

Imports

Before the war, a major portion of requirements was met from imports. The table below shows imports of lanterns (in lakhs) of all types in a few representative years :

Source	1936-7	1939-40	1941-2
U.K.	0.41	0.12	0.01
Hong Kong	0.15	1.16	3.74
Sweden	0.30	0.12	—
Germany	39.73	16.79	—
Austria	0.76	0.31	—
Hungary	0.06	1.66	—
Japan	2.13	0.47	0.10
China	0.13	0.32	4.30
U.S.A.	2.93	3.55	4.75
Other countries	0.06	0.05	0.04
Total	46.66	24.55	12.94

During the war imports from Germany were impossible. To fill the gap created, imports from the U.S.A. and U.K. increased. The Indian industry found it difficult to compete with imports and sought protection. The Tariff Board (1946) examined the case and recommended that the existing 30 per cent revenue duty should be converted into a 30 per cent *ad valorem* protective duty for a period of three or three and a half years from 1 October 1946. The Government accepted this recommendation. Protection was to last till 31 March 1949.

Imports of metal lamps in the last few years have been : 1948-9, 5,90,425 ; 1949-50, 11,90,980 ; 1950-1, 5,02,528 ; 1951-2, 2,31,068 ; 1952-3, 1,19,715 and 1953-4, 1,89,080. They have been mostly from soft currency areas. The industry's case for continuation of protection was considered by the Tariff Board in 1949 ; and the Government accepted the recommendation of the Board that the existing protective duty of 30 per cent *ad valorem* should be continued for another two years, i.e. up to 31 March 1952. The Board did not consider that the circumstances justified a quantitative restriction on imports for which the industry had asked.

Protection was subsequently extended up to 31 December 1954. An important recent development was the inquiry into the question of continuance of protection beyond 31 December 1954. The Tariff Commission reported that as the fair ex-works prices of indigenous hurricane lanterns were lower than the landed costs, ex-duty, of imported lanterns, the industry was no longer in need of tariff protection. The Government agreed with the Commission's conclusion and decided that protection would not be continued beyond 31 December 1954.

Among the more important ancillary recommendations were that 'suitable action should be taken by Government to end the practice of embossing on lanterns phrases indicating some sort of foreign origin, to which some of the Indian manufactures have resorted ; that the Indian Standards Institution should take steps to expedite the formulation of standard specifications for hurricane lanterns ; and that the Ministry of Transport should examine the position regarding shipping freights on hurricane lanterns from India and take suitable steps to relieve the Indian industry of any handicaps arising from this factor.' The Government is taking steps to prevent the use of false trade descriptions. The Indian Standards Institution has been asked to expedite the formulation of standards. The Ministry of Transport is examining the position regarding shipping freights.

Exports

The Government has given general permission to export lanterns to any country until further orders,* except to a country export to which is forbidden by any special law for the time being in force. Indian lanterns are being exported to Near and Far Eastern markets. Exports were expected to increase to about 10,00,000 per annum by 1955-6. If they are to be expanded, official attention will need to be given to anomalies in the supply of some essential raw materials, e.g. tinplate.

Any industry which within a few years has increased its exports nearly thirtyfold—for such is the record of this industry—merits congratulation. Figures for 1950-3 are : 1950, 15,036 ; 1951, 14,136 ;

1952, 1,08,264 and 1953, 4,49,734. And when it is realized that India has a vast home market to rely on and that, despite import restrictions imposed by countries overseas for balance of payments reasons and in a number of cases for protection of home industries, exports amount already roughly to 10 per cent of total production, Indian performance is all the more commendable. The industry is constantly striving to better its record. Prospects are brighter now than seemed possible a few years ago ; but this should not lead to complacency. The industry must make its goods severely competitive. It is largely upon efficiency in production—in particular the development of new and better techniques—that the industry's future in international trade depends.

Demand

Demand in undivided India was estimated in 1946 at 60,00,000 per year. According to the manufacturers, the partition of the country and inadequate supplies of kerosene oil had reduced the demand to about 30,00,000 per year—an estimate accepted by the Tariff Board (1949) as generally correct. Offtake in 1949-50 and 1950-1, as represented by the sum of home production and imports, was 29,90,000 and 40,00,000 respectively. India abounds in villages ; only 54 villages out of every 10,000 now have electricity, and it will be some time before the rural electrification schemes render lanterns unnecessary. Even in electrified areas, hurricane lanterns are being used as a 'stand-by'. For some years yet, therefore, demand is likely to grow. Home demand is expected to increase by about 18,00,000 lanterns by 1955-6 and export demand to about 10,00,000 per year. Total annual requirements by 1955-6 are estimated at about 60,00,000 lanterns. Indigenous capacity needs therefore to be fully utilized and expanded ; and to this task the State and the industry are applying themselves.

Sewing Machines

The sewing machine industry in India is of recent origin. Jay Engineering Works Ltd., Calcutta produced their first 'Usha' machine in 1937. During World War II the company was required by the Government to divert most of its capacity to the production of certain defence needs. Pressure gauges, vapourizing tubes, special types of stores, thread milling machines, aircraft components and several other precision stores were produced. The manufacture of sewing machines was practically confined to meeting the requirements of the Supply Department of the Central Government.

In 1943, the firm was given licences to import from the U.K. and the U.S.A. plant and machine tools for the manufacture of its speciality.

But it was only after the war ended that the company could resume its normal activities and organize its factory on mass production lines. The firm now manufactures under expert supervision almost all parts and components of hand and treadle domestic sewing machines except needles.

The Indian Sewing Machine Manufacturing Co. Ltd., Lahore and the Delhi Sewing Machine Co. Ltd., Delhi began manufacture in 1938, their brand names being 'Auluck' and 'Daisy' respectively. Both the firms discontinued production during the war. The former devoted a major part of its productive capacity to defence needs and the latter was constrained to close down as raw materials were not available. The firms planned to resume operations after the war, but the plans did not materialize.

In 1939, Messrs. K. C. Mullick & Sons Ltd., Calcutta established a factory for producing complete sewing machines. The trade name was to be Mullick. As with the other companies, the war affected the production programme. The firm reverted to the manufacture of sewing machines in 1945 after the war. The factory now manufactures almost all components of domestic and treadle machines except needles.

To the industry, in many ways the war was a setback—which came when it had hardly had time to find its feet.

Production

There are two types of sewing machines : the domestic and the industrial. Domestic machines are used for stitching light clothing ; and industrial ones for stitching heavy clothing, leather or hosiery.

Since the war, production of domestic machines has steadily increased :

Year	(Monthly averages)	
	Capacity (Single-shift) Nos.	Production Nos.
1946	1,225	510
1947	1,000	488
1948	2,000	1,668
1949	2,125	2,086
1950	3,125	2,574
1951	3,125	3,705

The interim index of industrial production, taking 1946 as the base : 100, shows production at 95.7 in 1947 ; 327.1 in 1948 ; 408.9 in 1949 ; 504.7 in 1950 ; and 848.0 in December 1951.

The table below summarizes the situation in the years 1952-4.

Year	No. of factories	Capacity (Single-shift)	Production
1952	2	41,500	50,040
1953	2	41,500	62,419
1954	2	41,500	80,198

It would appear that the above figures are exclusive of the output—about 3,000 machines per year—of the small, almost cottage, but nevertheless important, industry in the Punjab, run on the Japanese model.

Several units have worked double shifts in the last few years. Capacity increased from about 12,000 machines in 1947 to 41,500 by 1952. More particularly, during the last three years there has been considerable expansion of the two manufacturing units : Jay Engineering Works Ltd. and K. C. Mullick & Sons. Production has risen from about 6,120 machines in 1946 to 80,198 in 1954. There has been a corresponding increase in investment and in the number of workers employed. An export market has been established. An important development is the production of industrial sewing machines. In May 1952, Jay Engineering Works started manufacture for the first time in this country. And more recently a licence has been granted to Luxmi Narain & Co., Jodhpur for the establishment of a unit at Andheri, Bombay for the manufacture, in collaboration with a Japanese firm, of both industrial and domestic sewing machines. With an easier supply of raw materials, production programmes are now capable of much more rapid adjustment than they were a few years ago. After a study of the affairs of the industry, the Planning Commission reached the conclusion that a systematic development programme for a period of five years would be possible and useful to undertake. The development plan is detailed below :

	1950-1	1955-6
Number of units	2	2
Rated capacity (Numbers) . . .	37,500	91,500
Production (Numbers) . . .	32,965	91,500
Consumption (Numbers available for consumption)	53,390 (A)	80,000 (B)

(A) Excluding exports of about 3,000 machines.

(B) Excluding exports of about 11,500 machines.

A somewhat negative recommendation of the Planning Commission was that establishment of new units 'should not be considered until

1954'. The time is now ripe for a re-assessment of the position. Possibly the Tariff Commission will report on the need. Judging from the current rate of progress, an increase in total capacity to about 1,15,500 by 1955-6 seems likely, as against 91,500 envisaged in the Plan.

A calculation of this kind tends to underestimate the importance of quality. Increase in production is not, of itself, enough. Reports suggest that the Tariff Commission, claims by manufacturers that their products are as good as the best imported machines notwithstanding, is not completely satisfied with quality. The Commission is of the view that 'although some of the Governments and consumers have expressed a favourable opinion, much remains to be done to improve the quality . . . so as to bring it up to the highest international standards and to reduce the cost of production.'

Raw Materials

Raw materials required for production are :

1. Pig-iron for mechanite castings.
2. Steel of several kinds, e.g. high-speed, die steel, etc.
3. Wood (teak and plywood).
4. Painting and plating materials such as stoving enamels, lacquers, thinners, transfers, copper anodes, and nickel anodes.
5. Rubber rings and leather belts (for treadle machines only).
6. Abrasive paper and cloth.
7. Accessories, e.g. oil bottles, oil cans, needles, steel balls.

Free-cutting steel is produced in India but production is inadequate. The deficiency has to be met by imports, mostly from the U.K., Belgium and Germany. Nickel chrome steel, spring steel strips and silver steel are imported. Efforts are being made to produce in India more of the types of steel required. The wood required is available in India. Glue is imported. Such painting and plating materials as are available in India in satisfactory quality are used. The rest is imported. Rubber rings are available in the country. Requirements of leather belts are met partly from home production. About 70 per cent of requirements of abrasive paper and cloth are available in India. The rest is imported. Oil bottles and oil cans are manufactured in India. Needles are imported from Germany, the U.S.A. and Japan.

The Government has agreed to meet the industry's needs for pig-iron and steel from indigenous sources at controlled rates and to issue special permits for import of materials not available in India.

It was estimated that if the expansion of production contemplated were achieved, the following quantities of the principal raw materials and components would be required :

	1951 (Installed capacity 37,500)	1955-6 (Installed capacity 80,000)
<i>Raw Materials</i>		
Pig-iron (tons)	2,109	4,450
Steel (tons)	295	623
<i>Components</i>		
Steel balls (gross)	4,296	9,065
Needles (gross)	1,500	3,165
Painting & Electroplating materials (Rs)	98,000	2,00,000

The more complicated items of manufacturing machinery are imported. They come mostly from the U.S.A., Germany, Switzerland and Sweden. The rest of the requirements are obtained from home sources.

About 20 per cent of the labour is highly skilled ; about 60 per cent semi-skilled, and the rest 'unskilled'. Factories have training schemes in operation to ensure a constant supply of the type of labour required. Reports suggest an appreciable increase in production.

Since the war, there has been a rise in the cost of production, caused mostly by the rise in the cost of materials and labour. This has to some extent been set off by the increase in output which reduced the cost of production per machine.

There is no control over prices or sales.

Imports

The table below shows imports of sewing machines in two representative years :

	1938-9 (In thousands)	1948-9
U.K. ...	36.66	51.18
Germany ...	23.61	—
Japan ...	0.21	—
U.S.A. ...	0.30	1.86
Other countries ...	0.45	4.54
Total ...	61.23	57.58

Imports in more recent years have been :

	1950-1	1951-2	1952-3	1953-4
U.K. ...	20,167	23,468	15,124	9,198
U.S.A. ...	235	545	569	2,182
Other countries ...	3,788	5,385	4,791	3,015
<hr/>				
Total ...	24,190	29,398	20,484	14,395

It will be seen that the bulk of imports has been from the United Kingdom and that, generally, with an increase in home production there has been a corresponding decline in imports.

Increased facilities have now been provided for the importation of industrial sewing machines from 'hard currency' countries. Twenty-five per cent of the face value of licences can be utilized on the dollar area.

The industry sought protection and assistance from the Government in 1946. The Tariff Board (1947) reported that, as the industry was conducted on sound lines and had the advantages of an enormous home market and nearly all essential raw materials were available, it was eminently eligible for protection. It recommended that the then existing revenue duties should be converted into protective duties which should remain in force until 31 March 1949, and that if there was an appreciable fall in the c.i.f. prices or in the selling prices of imported sewing machines thereby jeopardizing the measure of protection, it would be open to the industry to apply to Government for a review of the case. The Government accepted these recommendations. It impressed upon the industry the necessity for research. The allotment of adequate funds for the purpose was suggested.

In December 1948, after a summary inquiry, the Tariff Board found that there was a *prima facie* case for the continuance of protection and recommended that, pending a detailed inquiry, the then existing protection should be continued for one more year. The Government accepted this recommendation and decided to continue protection until 31 March 1950. In May 1949 the detailed inquiry commenced. The Board submitted its report to the Government in November 1949. It recommended that the then existing protective duties, namely 24 per cent *ad valorem* on imports from the U.K. and 36 per cent *ad valorem* on imports from other countries, should be continued until 31 March 1953 and that existing facilities for transport of raw materials and finished products and for procurement of special steels, plywood veneer and boards, cellulose paints and plating materials and needles should be maintained. The Government accepted these recommendations. Protection was extended to 31 December 1953.

A further extension up to the end of 1954 was subsequently sanctioned. The need for its continuance is now under study. The industry has enjoyed continuous protection since 1947, and during these seven years it has made rapid progress. Indeed the Tariff Commission is of the view that the industry has amply justified protection.

Demand

Taking into account the growth of population, the rise in the standard of living, and the pent up demand during the war, the Tariff Board in 1947 estimated domestic demand in undivided India for the next three years at 1,20,000 per annum and recommended that necessary facilities for the import of machinery should be afforded and that the duty on such machinery should be refunded with retrospective effect from 4 May 1947.

The Tariff Board (1949) thought this estimate was on the high side. It estimated demand in 1949-50 at 80,000 ; in 1950-1 at 85,000 and in 1951-2 at 90,000. The proportion of demand between the two types of machines was put at : domestic machines, 60 per cent and industrial machines, 40 per cent. Proceeding on this basis, the Board arrived at the following figures :

		Domestic Machines	Industrial Machines
1949-50	...	48,000	32,000
1950-1	...	51,000	34,000
1951-2	...	54,000	36,000

The Tariff Commission received, in connexion with a more recent inquiry, estimates of demand ranging from 70,000 to 1,55,000 machines. The Planning Commission put total (domestic 80,000 and industrial 44,000) demand in 1955-6 at 1,24,000 machines. The sewing machine being an appliance of daily use, there is, the Tariff Commission feels, 'vast scope for developing the internal market by popularizing its use in remote places in the countryside and by making it available at a cheap price'.

The gap between production and demand is large. There is clearly 'still scope for investment of more capital either in the expansion of existing units or in the establishment of new. If new ones are to be established, it seems that units for the production of industrial sewing machines would be the most useful in present circumstances.

Exports

The export of sewing machines has been licensed freely since 1947.

Among the countries importing sewing machines and spare parts from India are Singapore, Australia, Ceylon, Saudi Arabia, Nyasaland, Kenya, Zanzibar, Southern Rhodesia, Mozambique, French Morocco, Tanganyika, Burma, Thailand, Iran, Syria, Belgian Congo, Uruguay, Nigeria, Indonesia, Uganda, Sudan, Afghanistan, Pakistan and Israel.

Exports have been on the increase. From about 1,000 machines in 1948-9, exports rose to 8,000 during 1952 and to 11,023 machines valued at Rs 18.8 lakhs during 1953-4 ; very near the target of 11,500 set for 1955-6 in the Plan. An analysis, however, of developments abroad emphasizes how unreliable these advances are as evidence of any trend. There have been fluctuations ; and these, however small, contrasted with the steady rise in production, have reflected not merely the relative pressure of home and overseas demand but the movement of prices of Indian exports compared with those of competitors. In the long run, the industry has got to do a great deal better. That means capturing a larger share of both the home and overseas markets in the face of increasingly tough competition. Commercial success now depends largely on the manufacturer's ability to modify his product rapidly to suit changing demands, his awareness of changes in technique and his readiness to embody them in the process of production. The more rapidly such changes are introduced, the more valuable they will be. And selling is not, and should not be, the end of the transaction. It needs to be followed up by the provision of an efficient and complete spares and repair service. Competition in export markets is making it more urgent than ever to reduce prices by raising productive efficiency. The increase in exports is not necessarily the beginning of a new trend ; a sharp fall in prices overseas could reverse the movement. The danger is that by overestimating the momentum of the change that has taken place and easing the pressure too soon, the good achieved may be undone. The real test will come if and when some of the importing countries find themselves with surplus capacity and are willing, to cut prices to expand exports ; or if there is a general recession when each exporter, by seeking to maintain his share of a reduced total world trade, produces the same competitive conditions. Reduction in price should result in a further increase in offtake. Indeed, according to the Tariff Commission, it would enable the industry 'to build up large, export markets, despite the rising tempo of competition abroad'.

By and large, however, the exports prospects are now much brighter than seemed possible a few years ago. On the evidence available, India should be able to sell at competitive prices. Capacity has been planned on the assumption that the industry would by 1955-6 export 11,500 machines. That target should not be difficult to achieve. A point well worth remembering is that exports on that scale should be

attempted only when possible without detriment to home consumers.

Bicycles

The bicycle industry may be said to have started in India in 1941. It might have started earlier but for the war, for in 1938 the Indian Cycle Manufacturing Co. Ltd., Calcutta placed orders for machinery in Germany. Before all the machines could be delivered, war broke out and the company had to alter its original programme and take to the manufacture of certain accessories and components of bicycles instead of complete bicycles.

In 1939 two other Indian firms were registered as public limited companies with the object of manufacturing complete bicycles. The two firms—The Hindusthan Bicycle Manufacturing and Industrial Corporation and the Hind Cycles—located their factories in Patna and Bombay respectively. The Hind Cycles were the first to put on the market bicycles manufactured in India. This was in 1941. The other company commenced production in 1942.

In 1942-3 the industry, although originally planned to produce bicycles for civil consumption, had to switch over to war production. Besides producing certain essential articles like wire contact frames, fuse caps, buttons, hospital and Red Cross equipment, etc., it supplied the Government during the war with about 50,000 bicycles.

In 1941-2, production (i.e. the number of cycles produced as also spare parts equated to complete cycles) amounted to 27,641 and imports to 54,455. In 1945-6, about 44,000 were produced and 76,141 imported. The increase in production was not very encouraging. The target set by the Government for 1946 was not achieved. The industry attributed the failure to insufficient supply, the rise in the cost of raw materials, labour unrest and high wages. Agreeing that the pleas were valid, the Tariff Board (1949) pointed out that they were, however, only part of the story. Lack of organization and relatively low standards of manufacturing technique, it said, were also responsible.

A third manufacturing unit has come into existence, the T.I. Cycles of India Ltd. They set up a factory in 1950 at Ambathur, 17 miles from Madras, in collaboration with Tube Investments Ltd. of Birmingham, for the manufacture of Hercules bicycles. It is a co-operative effort to produce 1,00,000 bicycles a year. The ultimate target is 2,00,000 a year.

Sen-Raleigh Industries of India Ltd. have set up a factory near Asansol in collaboration with Raleigh Industries Ltd., Nottingham, who will provide technical assistance. They have had sanction from the Government

for the manufacture of bicycles up to a maximum of 1,00,000 per annum. The firm have been granted import licences for a portion of the complete equipment proposed to be installed.

Atlas Cycles Industries Ltd., Sonapat, Punjab have received Government sanction for the assembly and manufacture of 1,00,000 bicycles a year.

India Cycle Manufacturing Co. Ltd., who are at present producing cycle parts, wish to assemble 10,000 bicycles per year.

Besides factories for complete bicycles, there are several small units manufacturing a large number of parts and accessories, e.g. tubes, pedals, axles, spokes, lamps, etc.

Raw Materials

The raw materials required are steel, ready components, rubber parts, consumable stores and accessories. A bicycle consists of about 150 parts and manufacture involves about 1,000 different operations.

The manufacture of bicycles continues to be dependent on imports of some raw materials and components. Not all types of steel required are available in the country. They come mostly from the U.K. and other soft currency countries like Germany, Belgium and Italy. For the bicycle industry to become self-sufficient it is very important that India should soon develop manufacturing capacity for such types of steel. It is learnt that Indian steel producers could supply alloy and tool steels if manufacturers 'bulked' their requirements. Otherwise production, they contend, would be uneconomic. Efforts are being made to produce within the country the types of steel required.

Tyres, tubes, handle grips, pedals and brake rubbers are all manufactured in India.

Most of the consumable stores (e.g. belts, emery powder, grinding wheels, fuel and fuel oil, leather and paints) are available in India. The quality is satisfactory. Almost all accessories (e.g. lamps, carrier stands, bells, pumps, tool bags and reflectors) are also manufactured in India.

A large number of small units are engaged in the manufacture of components and parts. The more important are about 24; most of them in East Punjab. These provide employment to a large number of skilled workers, and are an integral part of the industry. Progress in manufacture varies with each factory. In other words, producers are at different stages of competence. Some manufacture the bulk of requirements while others produce only a small fraction. The bigger companies are working to a phased programme of development spread over some years, embracing the manufacture of a large proportion of components. The highest percentage achieved by any one manufacturer

so far is reported to be about 90. Free wheels, spokes and chains were produced for the first time during 1952-4. Manufacture of steel tubes has begun. A firm has commenced manufacture of all components except spokes. Although several types of components are now produced within the country, production is not in all cases adequate in quantity and quality. A totally Indian-made bicycle will be possible, it is hoped, by the end of 1956. The value of Indian manufacture of cycle parts in the last few years (in thousand rupees) has been : 1950, 6,449.7 ; 1951, 9,460.4 ; 1952, 8,247.6 ; and 1953, 10,194.0, as against 1,276.9 in 1947. These developments have their origin chiefly in the need to meet new technical requirements.

Initially, the industry experienced considerable difficulty over labour, which lacked the necessary technical skill for efficient production. In the last few years, however, the situation has improved. Releases from the ordnance depots after the war helped recruitment. The mass of labour employed now is fairly skilled. Some have acquired a high degree of efficiency.

The industry in West Bengal has complained of the reluctance of workers to give of their best ; and that, to offset lower productivity, it is constrained to carry a large surplus staff. Higher costs in the circumstances, it points out, are inevitable. Possibly similar conditions prevail in other areas as well.

Till recently, in many cases bicycles and bicycle parts were being made in India on general purpose machines. The Government of India reduced the duty on imported machinery from 10 per cent to 5 per cent *ad valorem*. In the last few years manufacturers have imported the latest equipment.

Production

The table below shows the structure and installed capacity of the industry and production of bicycles from 1950 onwards :

	1950	1951	1952	1953	1954
No. of units	3	3	6	6	6
Capacity (Bicycles Nos.)*	1,20,000	1,20,000	3,89,500	4,17,500	4,37,500
Production (Bicycles Nos.)	1,04,005	1,14,275	1,96,956	2,64,169	3,72,365

* Capacity is estimated on a single-shift basis.

Investment in the industry since 1951 has amounted to about 221 lakhs of rupees. The establishment of four more units for the manufacture of complete bicycles has been approved. Permission has been given to Wearwell Cycle Industries Ltd., Delhi for the manufacture of bicycles in collaboration with the parent firm in the United Kingdom. Sanction has also been accorded for the expansion of capacity in T. I.

Cycles (India) Ltd., and India Cycle and Manufacturing Co. Ltd. The total capacity of the industry, on completion of these schemes, is expected to be about 7,18,500 bicycles. Whatever figures we choose out of the somewhat limited range available, they have inevitably to be considered against the background of the First Five-Year Plan. It is only on the basis of such comparison that conclusions can be drawn about changes in efficiency. The target set there for 1952-3 is 4,30,000 bicycles and for 1955-6, 5,30,000. In itself this has doubtless been an appreciable advance from the position only a few years ago; nevertheless, the improvement has still far to go before there can be warrant for confidence or self-congratulation. There is no manufacture yet of the tandem and carrier types of bicycles. In the hope of a salutary effect on price and quality, and of exports absorbing the difference (30,000 bicycles) between output and offtake at home, the target for installed capacity has been fixed above estimated demand. How far, if at all, the loss resulting from unused capacity and the possibility of increasing competition in the world market entered into these calculations is somewhat obscure.

Production, although still below rated capacity, has shown marked increase. One of the producers has recently decided to work on a double-shift basis. A few others may soon follow suit. Better supplies of steel and other materials now give manufacturers greater freedom of planning.

In spite of the relatively favourable present position, certain fundamental circumstances remain somewhat unsatisfactory. Instances in point are the price and quality of the Indian bicycle.

As to quality, the Director-General of Industry and Supply reported in 1946 that that of the indigenous cycle was passable but inferior to the best foreign make. This, he said, was because not enough attention was paid to the metallurgical side of the components manufactured, the wearing qualities of the moving parts left much to be desired and labour was not so skilled as in the United Kingdom. Among other causes mentioned at the time were that the raw materials were not of proper specification and that there were no arrangements for a periodical inspection of the accuracy of tools, dies and gauges. The Tariff Board (1949) reported that the Indian bicycle, *vis-à-vis* the British, was heavier; that the finish of the moving parts was not up to the requisite standard and that consequently it involved greater strain in riding; that the average life of the Indian bicycle was about 3 years as compared with 7 or 8 of the British bicycle; and that the rims were of poor quality. The available evidence, the Board added, showed that, notwithstanding the lack of suitable raw materials and machinery, Indian manufacturers had been able to effect substantial improvements in the design, structure

and finish of their bicycles ; and that if the supply of raw materials and machinery increased, products could before long be improved and brought up to the standard of imported bicycles.

The Tariff Board (1946) attached great importance to research and recommended that it should be made a condition of the grant of protection that the bicycle industry should actually spend or set apart specified amounts for research. The Government accepted this recommendation and informed the industry that it reserved the right to withdraw the protective duties if certain specified amounts were not set apart for research. Manufacturers have since arranged to send representatives and engineers to the U.K. and the U.S.A. to study the technique and organization of the bicycle industry in those countries. In 1947 the industry spent about Rs 75,000 and in 1948 about Rs 90,000 on these schemes.

Improvement in quality, it needs to be remembered, is relatively easier for the larger manufacturers than the smaller ones. It is here that State assistance can play a significant part. The smaller units lack the necessary finance and/or technical resources. The provision of adequate teaching and research facilities is, for instance, a direction in which much could be done.

The Government has set up a Development Council for the industry under the Industries (Development and Regulation) Act, 1951. Essentially, its functions are to co-ordinate the production programme, suggest norms of efficiency with a view to eliminate wastage, improve quality, reduce costs and obtain maximum production. The setting up of such a Council is welcome. The diverse functions assigned to it reflect in some measure the effort essential to put the industry on a proper footing. Apparently the Council will have to function within the framework prepared by the Planning Commission.

Over price and quality of the Indian bicycle the Council is much exercised. In January 1954, its Chairman remarked : 'The present-day Indian cycle industry cannot compete with foreign manufacturers in price and hence has to be afforded protection in the form of high duties and restrictions on the quantum of imports.' 'The quality of some of our products,' he added, 'cannot be taken as of high standard.'

Prescribing proper standards for components is one way of improving quality ; and in this direction there has been some progress. Draft standards for bicycle components prepared by the Indian Standards Institution are under study by experts in India and abroad. Finalization is expected soon. The proposed standards aim at making various components interchangeable, thus simplifying replacement.

In June 1951, the Government of India, under the Supply and Prices of Goods Act, 1950, fixed maximum retail prices.

Relations between the industry and the trade were for some time not altogether happy. There has since been a rapprochement. In the words of the Minister of Commerce and Industry, 'the trade had come to recognize that it must depend on the home industry if it was to grow.'

Imports

Imports before the war were mainly from the U.K., Japan and Germany. During the war supplies from Japan and Germany ceased. The main source was the U.K. Imports were progressively on the decline. The table below gives the figures for two important years :

Year	No. of Cycles	Value of Cycles	Value of parts and accessories
1936-7	1,59,450	Rs 45,10,000	Rs 61,47,000
1944-5	37,391	Rs 25,15,713	Rs 29,44,265

The rate of import duty was 36 per cent *ad valorem* Standard, and 24 per cent *ad valorem* British Preferential. The Tariff Board (1946) recommended that the *ad valorem* duty of 24 per cent should be converted into a protective duty at the same rate to remain in force till 31 March 1949. The Government accepted the recommendation.

In the post-war period, imports have been mostly from the U.K., which is the biggest producer of bicycles in the world.

Imports of bicycles, parts and accessories in recent years have been :

Year	No. of bicycles imported	Cost of complete bicycles (in rupees)	Cost of bicycle parts and accessories (in rupees)	Total cost (in rupees)
1949-50	2,68,148	2,51,86,080	1,59,18,684	4,11,04,764
1950-1	1,63,811	1,46,86,586	96,41,932	2,43,28,518
1951-2	2,83,127	2,82,69,340	1,44,30,147	4,26,99,487
1952-3	1,97,565	2,09,44,787	1,35,46,322	3,49,91,109
1953-4	90,362	96,50,900	94,93,168	1,91,44,068

There have been substantial reductions in terms of value, and, probably more or less commensurately, in volume. It is expected that by the end of the Plan periods, the value of the imported components required will not on average exceed Rs 7 to 8 per bicycle.

Comparisons between the levels of production and imports are of little use, and indeed are, in a sense, crude. *Prima facie*, the steady decline in imports suggests progress in home manufacture. Analysed in greater detail, imports present a rather different picture. It is assumed that a given volume of imports supports a much bigger pyramid of home production. On the other hand, increases in imports might

merely aggravate the overseas balance, for the higher level of production would make, for some time yet, little contribution to exports.

The Development Council attributes the demand for increasing imports of bicycle parts 'partly to prejudice and partly to lack of standardization'. It has set itself the task of making the industry independent of imports; and has appealed to the cycle manufacturing industry to import as few parts as possible. Another appeal almost identical has come from the Planning Commission. Co-operation between the small-scale and the cycle manufacturing industry is urged. The Commission considers that 'if the small-scale manufacturers of cycle parts and other accessories were properly organized and supplied with the necessary raw materials and technical supervision, they are capable of being developed into an independent branch of the main cycle industry.'

The Government has under consideration plans of assistance to small-scale manufacturers of bicycles parts and accessories. The supply of the necessary raw materials, organization of the industry on co-operative lines and arrangements for sales of finished products through co-operative societies are contemplated.

Small wonder, therefore, that the Government has not accepted the recommendation of the Tariff Commission that the duty on parts and accessories of cycles should be reduced to the same level as that on complete cycles. Existing rates are to continue, for 'much of the production is in the hands of small-scale producers who face peculiar difficulties'. Bicycle manufacturers have questioned the propriety of asking them to subsidize small-scale units. Such a policy, they point out, if pursued, might prove disastrous to the whole industry.

The Tariff Board (1949) recommended a protective duty of 60 per cent *ad valorem* on bicycles and bicycle parts and accessories, to be levied on imports from the U.K., and left it to the Government to adjust the standard rate in the light of the commitment under the Indo-British Trade Agreement of 1939. The protection, the Board added, should remain in force for a period of three years ending 31 March 1952. The period of protection was since extended to 31 December 1953, and the rates of import duty were then: 63 per cent *ad valorem* British Preferential, 73 per cent *ad valorem* Standard.

In the rate of duty recommended by the two Tariff Boards, allowance was made (Rs 12 per bicycle) for prejudice against the Indian product. The object of this allowance was to enable the manufacturer to sell his product cheaper than the imported article and thus neutralize the prejudice. The Government accepted the recommendation.

The industry has been under constant watch and review. Inquiry into the need for continuance of protection was initiated in April 1953. In September 1954, the Government of India announced its decisions

on the report of the Tariff Commission. The Government accepted the Commission's recommendation that the period of protection should be extended up to 31 December 1956; also the recommendation that the *ad valorem* rate of duty on complete cycles of British manufacture should be reduced to 45 per cent exclusive of surcharge. Another important decision was that an alternative specific duty of Rs 60 per bicycle should be levied. This was due largely to the fear that the reduced rate of duty might not give adequate protection against cheaper bicycles. It was, as explained in a communique, felt necessary 'to ensure that the home industry was not threatened by the import of very cheap cycles'. The rate of duty on cycles of non-British manufacture will be 10 per cent *ad valorem* in excess of the duty payable on cycles of British manufacture. The quota for cycles from soft currency areas has recently been increased from 25 to 30 per cent. Mention has already been made of the decision on the recommended reduction in the duty on parts and accessories of cycles. Several other ancillary recommendations for assistance to both the large-scale and small-scale wings of the industry are reported to have been accepted. These should be a spur to production, which is yet far short of demand.

Tariff protection has not been the only form of assistance that the State has offered. The distribution and prices of steel are controlled by the Government, which has sought to meet the industry's demand as far as possible. In accordance with the recommendations of the Tariff Boards (1946 and 1949), Government departments, Central as well as Provincial, have obtained their supplies of bicycles largely from Indian factories. Raw materials have been released and licences issued for import of components. When schemes for construction of factories have been approved by the Government, building materials have been supplied and import licences issued for capital equipment. Together, these measures have contributed substantially towards an increase and improvement in production.

Demand

Demand, being largely dependent on price and quality, has not been static. The trend, in fact, has been generally upward. Some idea of the demand prior to World War II can be had from the import figures for 1936-7, 1937-8 and 1938-9. They are 1,59,450, 1,70,664 and 1,38,036 respectively. During the war, the demand was not adequately met. Demand since the war has increased considerably. The use of bicycles has become more common. The Tariff Board (1946) estimated the demand for the next three years at more than 6,00,000 per year—about three times the pre-war annual demand. In retrospect, the estimate appears much

too high. The Tariff Board (1949) assessed demand in 1949-50 at 3,50,000 ; in 1950-1 at 3,75,000 and in 1951-2 at 4,00,000. In 1953, the Tariff Commission estimated demand in 1955 at 4,25,000 and in 1956 at 4,50,000 bicycles. According to the Planning Commission, it was expected to go up to 5,00,000 by 1955-6 at the present level of prices.

There is still wide disparity between output and requirements. The industry is at present meeting only about 50 per cent of the country's estimated current demand of about 4,00,000 bicycles.

The number of bicycles in India is estimated at about 15,00,000. If this is correct, it works out to approximately 3.85 bicycles per 1,000 of population. Here are some comparative figures :

Country	Number of bicycles in use	Number of bicycles per 1,000 of population
Britain	... 1,20,00,000	255
U.S.A.	... 1,00,00,000	74
France	... 1,00,00,000	238
Denmark	... 20,00,000	539

It is said that in proportion to population India has the lowest number of bicycles of any country in the world, with the exception of China. But there is little doubt that demand will grow. The indications are clear. There is in the size of the country, the large population, the relatively undeveloped state of other forms of transport, the low initial cost of bicycles, the negligible cost of their maintenance, the extent of State support given and promised and the gradual improvement in the standard of living of the people ample promise of an expanding market. The Government envisages 'a time when in relation to the vast population, at least 10 per cent' will be using a bicycle.

With a reduction in the cost of production and improvement in quality, exports, particularly to countries in South-East Asia, where there is a large demand, are a possibility well worth exploring.

The development programme assumes an element of luck. About 30,000 bicycles are expected to be exported by 1955-6. The figure is essentially a target. It is an estimate of what the industry should achieve. It is not a forecast—the planners appear to have been thoroughly impressed by the difficulty of making anything but the most tentative ones—of the expected level of demand abroad for Indian bicycles. Indian manufacturers are looking overseas for the sale of a proportion of their turnover. Reports on exports by land

have not been altogether reassuring. Consumers in Tibet have complained that Indian bicycles have not 'proved equal to the arduous conditions of weather and terrain there and that breakdowns have been frequent'. And an avoidable aggravation, it appears, has been the absence of spare parts and repair facilities. Together, these have made marketing the Indian product in Tibet very difficult. The volume of production now matters less than producing bicycles of the right type and quality at competitive prices. The need is for a sound base on which to lay the foundations of export business.

General Prospects

In the early years, output in the light mechanical engineering industries was small and far from well organized. Companies were largely engaged in the early phases of production—the tooling-up stage. The war period was one of adaptation to current needs, as well as, in some cases, of expansion. Since peace returned, opportunities of scientific development to meet the demands of a growing market have come to be appreciated and advantage is being taken of them.

Pre-war points of reference, however comforting, are so distant and were themselves so exceptional in many respects that they can help us little. These industries, in the years immediately after the war, had to face the problem of conversion from war to peace-time production. The statistics given in separate groups show the change that took place in the structure of Indian production.

Iron and steel supplies are basic, and requirements tend to be specialized. The reluctance of Indian iron and steel companies to make the necessary production changes unless the orders for special steels are substantial is understandable, for otherwise they might throw out of balance the production of other types.

Supplies from abroad are uncertain. Were it possible to forecast, even approximately, the level of military and stockpiling purchases, the situation might be less obscure. Prices continue to be high. That some of the shortages are quantitatively small is poor consolation. In the course of expansion, new marginal shortages may develop, changing sufficiency into scarcity. Thus there are limits to development programmes, though the need for expansion is urgent.

For several years, production was hindered in some lines by shortage of capacity, and throughout by a shortage of the right types of steel. The latter, in particular, continues to be the dominating feature of the industry's economy, and emphasizes the fundamental precariousness of our position. For the relatively short run, imports seem inevitable; and for the years to follow, hopes are placed in the current expansion of the iron and steel industry.

In the present state of statistics, it is not possible to assess accurately the changes in productivity compared with pre-war. The position needs to be examined industry by industry. Comparisons can be meaningful only when figures for production and labour are available in much greater detail than can be had. What is clear, however, is that too often machinery was at the mercy of insufficiently skilled operators and received inadequate 'maintenance' attention. In consequence, defective design and faulty construction showed up all too quickly.

The manpower needs of the industries over the next few years are likely to increase substantially. A stable labour force has to be built up. It seems essential to increase and improve facilities for technical training. Otherwise a grave shortage may develop.

Few small-scale manufacturers have been able to afford the luxury of up-to-date equipment. Fresh capital is hard to obtain.

There are indications that the private sector is gradually gaining confidence. The rate of investment has been rising, though erratically, in recent years; and its emphasis has changed. While early after the war it was heavily concentrated on a few industries, it is now widely spread. And help has come from the Industrial Finance Corporation. Out of the total sum of Rs 20.74 crores sanctioned as loans for all industries during the last six years, iron and steel light engineering industries have received Rs 1.12 crores.

Structurally, the industry must be said to be weak. A study of the documents so far available reveals little more than a skeleton of organization. There are several uneconomic units which impede the flow of trade on a competitive level. Direct contact between the maker and the user is essential if faults in manufacture are to be quickly removed and the users' special needs are to be fully and satisfactorily met.

In keeping with the index of industrial production, which rose steadily (base 1946 : 100) from 105 in 1950 to 140 in the first five months of 1954—about 33 per cent higher than the level in 1950—the overall trend of production in light mechanical engineering industries has been upward; 'overall', because the stability of the total index conceals certain divergent movements of its components. Over 1952, the output of hurricane lanterns increased by nearly 10 per cent; sewing machines also moved up by 17 per cent; bicycles were even better with a percentage of 34; the others were somewhat unsteady, but latterly have begun to improve.

Statistics of production given illustrate development and also reflect the manufacturing difficulties involved.

A blemish, however, is the dissipation of activity—in other words,

lack of specialization. It is an avoidable addition to the general economic uncertainty.

The mainspring of this progress has been the recent relatively easy, although not yet fully adequate, availability of the right type of raw materials. The events of the last few years suggest that the industry was made to pause and think before planning expansion; but there is nothing inherent in the economic situation now to prevent it from moving forward again—and on sounder lines. And that process, begun in 1952, has made some headway. The prime means to increased production was seen to be an expansion of, and a conversion within, the industries. This involved radical shifts of resources. Several firms installed new machinery. There was a transfer of capacity and labour to the relevant sections. The Planning Commission is setting much store by the development programmes under implementation.

Although the position in some cases is confusing, by and large it seems that development of these industries in the post-war period has led to a considerable reduction of imports. In seven brief but eventful years since the war the basic statistical position of many of these industries altered considerably to India's advantage. Some have now set themselves export targets—a welcome development.

Another welcome development was the setting up of the Engineering Capacity Committee to report on the most efficient use of national resources. The Committee is visiting factories all over the country and is continuously bringing to the notice of the Government cases where, through the addition of balancing plant or otherwise, new lines of production can be set up to manufacture items for which the country is still dependent on imports.

Admittedly the policy of the Government of India, concerted with the activities of the industries, has contributed much. It would, however, be fatuous to pretend that these fairly satisfactory results were entirely due to brilliance in planning and steadfast resolution in carrying the plans through. There was a great deal of plain luck as well. Indeed, one might be tempted to conclude that in the immediate post-war years all the 'evil spirits' combined against these industries, while in the last few years the 'good fairies' for some reason have had it all their own way. What the policies succeeded in doing was to take some of the strain off the industries' economy so that they were able to adapt themselves more speedily to a changing market. The important point about the Planning Commission's targets is that they represent a long-term view, calling for active official support as well as exhortation. The fear that in terms of volume, production at the end of the period, far from being inadequate, may be in burdensome surplus does not, judged by the trend of demand, seem justified.

In several cases, assessments of change in quality can only be made on an impressionistic basis, which is obviously hazardous. Accepting it for want of an alternative, it seems that quality varies from manufacturer to manufacturer. That there has been improvement, however slow, is indisputable; but this does not warrant complacency. Some manufacturers seem reluctant to subject their products to official tests while they are earning good profits in a sellers' market. This shortsightedness is a bar to progress. Little attention has been paid to research. It is only latterly that the Government has offered to help. Important work on standardization continues.

Most of the physical controls over production, distribution and prices have been or are being abolished.

Imports are a puzzling picture. There are 'daubs' of both restriction and liberalization. This is perhaps because the Government's position is somewhere between that of an authority pledged to protect and foster industrial interests and that of the economists who are supposed to be qualified to assess home trends against the world background.

The Tariff Board has held inquiries from time to time; but unfortunately there is little in the later reports to show that adequate action had been taken on the recommendations of the earlier. However, the Government has made notable efforts to instil a sense of security into the industry. Tariff protection, assistance in obtaining raw materials and components and inspection of quality are cases in point. The habit of providing price supports comes easily nowadays. Tariff protection has been given wherever it was thought necessary. Such a policy is doubtless desirable; but only up to a point. Indulged in excess, 'feather-bedding' is injurious. Industries should be expected to stand on their own feet once they have passed the first few formative years.

The end of the war released a good deal of delayed purchasing, and increasing industrialization has since kept demand at a high level. In the years to come, demand is likely to increase steadily. There exists a large field of potential expansion for small manufacturers without fear of immediate competition.

The market for Indian goods overseas, though partly governed by the scale of total world trade, is what Indian manufacturers and traders choose to make it, by their readiness to meet customers' requirements, their keenness to sell, their speed in delivery and their willingness to take risks. In other words, the industry must go into the export trade 'as lightly burdened and as nimbly competitive as it can'.

Experience has shown that increases in production do not mean much by themselves. They must take place within the framework of an appropriate industrial and financial policy. There is evidence of a

laudable desire to move towards a fiscal system which gives adequate scope for incentives.

Because there are so many conflicting factors, any forecast of the future is liable to wide error. All that can be said in present circumstances is that the general situation seems hopeful.

CHAPTER VI

THE LIGHT ELECTRICAL ENGINEERING INDUSTRIES

'LIGHT Electrical Engineering Industries' is a somewhat indefinite term, capable of various shades of meaning. For two reasons, it seems best to confine the reference to a few specific industries and to keep others resolutely in the background.

First, because otherwise the canvas might become overcrowded and the outline of the main object impossible to preserve. Secondly, because many of the others are still in the early stages of development and are not truly representative of the present industrial order in India.

Were it not so familiar, the wide range of uses to which the products of these industries are put would be startling.

The electric motor, for instance, is used in both industry and agriculture to perform several diverse and difficult operations.

Benefits have been twofold : economy and efficiency. It has meant less labour, and there has been greater speed and accuracy in execution. Instances can be multiplied. And it is too early yet to assess their full potential. Interest in other possibilities is quickening.

In the last few years, considerable progress has been made in India in the application of electricity to industry. From this, several advantages have accrued. Production in many lines has not merely mitigated the pressure of demand but also reduced the country's imports. Indeed, in some cases exports have been possible. There has been increasing utilization of indigenous raw materials. New sources of employment have been found. Since the aim is to assess approximately the totality of achievement, the more important light electrical industries have been brought together here for study.

Electric Motors

The electric motor is said to be the most compact and convenient means of driving all kinds of machinery. It is a vital link between the supply of electricity to, and its utilization in, industry and agriculture. As a source of motive power in such large-scale industries as textiles, coal-mining and traction, its use is almost universal. In its lower horse-power range, it can be used to build up and maintain many cottage industries such as sewing, oil-extracting, etc.

It is hoped that cottage industries will take increasingly to its use in

the manufacture of several small consumer goods. In agriculture, it has an almost unlimited field of application. For instance, it can be employed to drive irrigation pumps.

There are many types and designs of electric motors but they may be classified broadly into two main groups : the first being those operable on alternating current, and the other, those operable on direct current. The type varies with the purpose for which it is intended.

The first to manufacture electric motors in India were P.S.G. & Sons Charity Industrial Institute, Peelamedu, Coimbatore, who produced annually, before the war, about 150 motors of A.C. three-phase squirrel-cage rotor type from 1 to 10 h.p. The next in the field were Kirloskar Brothers who started manufacture in 1939.

With the outbreak of World War II, owing to difficulties over shipping space and the enormous home demand in exporting countries, imports of electric motors declined. This provided a stimulus to Indian manufacturers. New units came into being. Indeed it may be said that the growth of the industry in India is the result largely of war and post-war developments. The Government assisted in the process by the release of raw materials, where available, and issue of licences where imports were necessary. In a way, it was a form of production control. At the end of the war the installed capacity for A.C. three-phase squirrel-cage motors of 1 to 30 h.p. stood at 60,000 h.p. per year or 12,000 motors. Progress after the war has also been most heartening.

Production

According to the Ministry of Commerce and Industry, the situation in recent years has been :

	1950	1951	1952	1953	1954
No. of Units	10	—	12	12	12
Capacity (h.p.)	1,49,500	1,52,000	2,00,000	2,00,000	2,00,000
Production (h.p.)	81,831	1,41,900	1,57,200	1,62,525	1,86,644

Production of fractional h.p. motors commenced in 1947. About 800 motors were produced. The annual capacity of the industry in 1948 was estimated at 1,50,000 h.p., accounted for by as many as 20 production units. Shortly after, the weaker units went out of production—perhaps as a result of the expansion of the better organized ones. By 1949 there were only 13 units. But annual capacity had increased to over 2,00,000 h.p. The industry was fully equipped to meet current needs of A.C. three-phase squirrel-cage motors from 1 to 30 h.p.

By 1950 installed capacity had increased to 1,49,500 h.p. ; the range of production had expanded to 50 h.p. in the squirrel-cage and slipping types of A.C. motors ; two firms, one in Calcutta and the other in

Bangalore, had completed plans to extend the range to 100 h.p. ; and the manufacture of special types of high-torque¹ motors, specially needed for the operation of looms in the textile industry, had commenced.

By the middle of 1951 Indian production on an organized scale covered three-phase alternating current electrical motors up to 70 h.p. Present installed capacity is estimated at 2,00,000 h.p. Although the production trend is upward, it is still much below capacity.

There are about 12 firms in operation. The more important ones are in Calcutta, Bombay, the Punjab and South India. Producing units are said to be utilizing approximately only about 55 per cent of installed capacity and manufacture is as yet mainly of motors up to 15 h.p., in respect of which the industry can reasonably be expected to meet the country's full requirements.

The fall in production in 1949 is attributed by the industry to the OGL under which a large number of electric motors were imported. The increase in home production since then was ascribed to the fall in imports as a result of the Korean war, stockpiling programmes in exporting countries and the reversal in Indian import policy in regard to electric motors.

For diversification of production, the Tariff Board (1949) suggested to the industry the manufacture of transformers, switch gear, pumping sets and similar articles for which a portion of the same equipment and machinery as is required for electric motors could be utilized. The bigger units are now manufacturing these items in India.

Another suggestion was the possibility of standardizing the size and design of laminations for each type of electric motor. The standardization of winding shafts and ball-bearings should, the Board added, be considered in consultation with the Indian Standards Institution. The specification for three-phase induction motors used in industry (i.e. motors having a rated output of one h.p. and above) has been published.

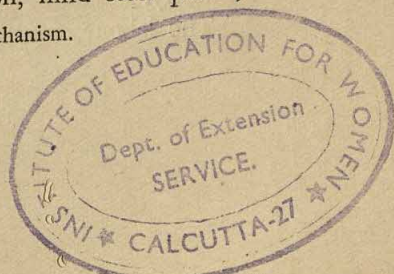
The Tariff Board (1947) reported that the industry was well organized.

Raw Materials

Of the raw materials required the following are imported: insulated copper wire, copper ingots, leatheroid, micanite and mica cloth, vulcanized fibre, empire cloth, sleeves and tubes, bakelite boards and sheets, insulating varnish, special cotton tape, mild steel bolts, nuts, etc. of special sizes, ball and roller bearings, and some special components.

The following are available in India: electrical steel sheets and stampings, cables and flexibles, insulated winding wire, electrotype copper bore wire, strips, brass and rods, cast iron, mild steel plates,

¹ torque: the twisting or rotary force in a piece of mechanism.



sheets, rods, bars, etc., non-ferrous metals (other than copper), some insulating varnishes, cotton tape, mild steel bolts and nuts, etc., painting materials and some components.

Indian production of electrical steel sheets is as yet inadequate. To encourage the indigenous production of electrical sheets and stampings and to place all Indian manufacturers of electric motors on an equal footing as regards supply of raw materials, the Tariff Board (1949) recommended that the ban on imports of electrical sheets and stampings should be continued and that licences to import stampings should be granted only in exceptional cases where the required quality and/or design could not be manufactured locally. The Government promised to give due consideration to this recommendation within the framework of their general import policy, but there is now no restriction on imports of electrical sheets and stampings. Prices, however, are high.

Two important suggestions were made by the Tariff Board (1949) for improvement of the raw material position. They were to reduce the quantity of iron castings used to the minimum necessary for the efficient functioning of motors and to explore the possibility of obtaining castings and copper conductors in the cheapest market. Reports indicate that the industry had not been unaware of the advantages that would accrue from such a course and that certain sections of the industry had already proceeded far in those directions.

The raw material situation is not altogether satisfactory; but there is some comfort in the fact that many of the more important raw materials are available in the country; that they conform to qualitative standards; and that this industry is more favourably placed in regard to indigenous availability than several other light electrical industries. Attempts are being made to produce in India many more of the raw materials now being imported, and the State is assisting in the process.

Supplies of machinery have come mostly from the U.K.

The Tariff Board (1947) recommended that the duty paid on manufacturing machinery imported into India should be refunded. In October 1948, the customs duty leviable on imported industrial machinery was reduced from 10 per cent to 5 per cent *ad valorem*. This included machinery for manufacturing electric motors.

The industry asked for a higher depreciation than the usual 10 per cent per year on the ground that replacement of machinery was much quicker in this industry than in many others. The Tariff Board thought it was not necessary to examine this demand in detail. It suggested, however, that if and when the balance tilted against the industry, this point might be considered as a possible source of assistance to the industry.

The labour employed is estimated at 1,600 workers.

In regard to quality, the Tariff Board (1947) reported that Indian-made electric motors were as good as imported ones.

The industry suggested a cess of 5 per cent on imported electric motors to raise funds for research on electric motors. The Tariff Board (1947) was not in favour of the suggestion. Such a step, it said, would raise the prices of electric motors. It was, however, prepared to treat any reasonable expenditure on research, when actually incurred, as a legitimate item in the cost of production.

Imports

Some idea of the quantity of imports before the war can be had from the figures : 1936-7, Rs 25,25,302 ; 1937-8, Rs 36,73,381 ; 1938-9, Rs. 63,12,027.

The figures for 1941-2 and 1943-4 illustrate the decline in imports during the war : they are Rs 53,29,515 and Rs 42,23,342 respectively.

After the war imports (in lakhs of rupees) have been : 1946-7, 95.78 ; 1947-8, 176.59 and 1948-9, 314.43 ; 1949-50, 252.312 ; 1950-1, 141.03 ; 1951-2, 111.74 ; 1952-3, 122.90 and 1953-4, 143.70. Separate statistics for the various types are not readily available.

The Tariff Board held an inquiry into the affairs of the industry in 1947, and reported that the industry qualified for protection. It recommended that the prevailing quantitative import restrictions should be withdrawn as healthy competition from abroad was desirable to maintain and improve the quality of the Indian product ; and that the prevailing revenue duty of 10 per cent *ad valorem* should be converted into an equivalent protective duty which should be in force till the end of March 1950.

In April 1948, the Government accepted these recommendations. The protective duty of 10 per cent *ad valorem* recommended in respect of 1 to 30 h.p. was extended by Government to all electric motors. The decision to withdraw quantitative import restrictions was implemented in September 1949, when electric motors of 30 h.p. and below were placed on OGL. It was thought that there would be no danger of the Indian market being flooded with imports from abroad as the supply position in the exporting countries continued to be tight and prices there showed an upward tendency. Events proved this assumption wrong.

The continuance of protection was considered by the Tariff Board early in 1949. The Board submitted its report to the Government in September that year. It recommended that in view of the large stocks of imported motors and the fact that the indigenous industry could meet the entire requirements of the country in respect of motors of 1 to 15 h.p., imports of motors up to 15 h.p. should be restricted until the present stocks were disposed of ; that, as indigenous production was

mostly confined to motors up to 15 h.p., for which there was a regular demand, and as there was a possibility of imported motors of 15 to 20 h.p. offering competition to indigenous motors of 15 h.p., the existing protective duty on motors of 1 to 20 h.p. should be raised from 10 per cent to 15 per cent *ad valorem*; that motors of h.p. above 20 should be removed from the protected category; that, in order to encourage the manufacture of fractional motors in the country, the same protective duty should be levied on such motors as had been recommended for motors of 1 to 20 h.p., i.e. 15 per cent *ad valorem*; that component parts such as are specially designed for the manufacture of motors of a horse-power not exceeding 20 and have been given a special shape or size for the purpose, should also be protected and a duty of 15 per cent *ad valorem* levied on them; and that the revised measure of protection recommended in respect of motors up to 20 h.p. should be continued for a period of three years beginning 1 April 1950.

The Government, while agreeing that protection should be continued up to 31 March 1953, did not consider that the quantum of protection these enjoyed should be altered immediately. The position, it said, would be reviewed from time to time as and when necessary, and certainly before the expiry of the period of protection. As for restriction on imports of motors up to 15 h.p. until the present stocks had been exhausted, the Government promised due consideration within the framework of its general import policy.

Tariff protection, first granted in 1948, was extended up to 31 December 1955. The Government has since accepted the Tariff Commission's recommendation that tariff protection should be extended for three more years, that is, up to 31 December 1958. The Planning Commission has recommended that 'with a view to encouraging the indigenous industry, the import of those types of motors which are already being produced in the country should be restricted to the minimum.' Action has yet to be taken on the recommendation that import statistics be reorganized.

Exports are negligible.

Demand

A.C. three-phase squirrel-cage motors account for the bulk of the demand in India. They are widely used on account of their simplicity and relative robustness of construction.

Annual demand before the war has been assessed at 1,00,000 h.p., equivalent to 20,000 motors; and demand in 1947 at about 3,00,000 h.p. The Tariff Board (1947) estimated total annual requirements of electric motors of all categories in the next three years at 5,00,000 h.p. or 1,00,000 motors, taking 5 h.p. to be the average representative type.

The Tariff Board (1949) put current annual requirements at 3,00,000 h.p., a little over 1,00,000 of which, it thought, would represent motors up to 30 h.p.

In 1950, the D.G., I & S Development Committee, assuming that the rate of generation of electricity and the level of industrial activity in the country would continue to be the same as it was then, assessed that the total requirements of A.C. three-phase squirrel-cage and slipring conductor types of motors up to 50 h.p. would increase to about 3,20,000 h.p. by 1956.

Increased imports reflect the rapidly growing demand inevitable in industrialization. But of demand, either current or in the near future, there is no reliable estimate. The most important is that by the Planning Commission, which put demand in 1955-6 for A.C. three-phase squirrel-cage and slipring induction types of motors up to 50 h.p. at about 3,20,000. An accurate estimate is obviously difficult, for there are several uncertain factors. Electric motors are finding ever-increasing application. Their role in lift irrigation by means of pumps has yet to be properly evaluated. It is expected that cottage industries will also use them in some suitable form. How much electric power will be available in the next five or six years is as yet unknown. This emphasizes the need for a reappraisal of effective demand. Only then, it seems, will it be possible to fix targets, if not for the long term, at least for the short. That demand is growing, and will be growing for a good many years, there is little doubt.

The use of power-driven plants in industry and agriculture in India is as yet undeveloped. Electric power available for the operation of these motors is as yet inadequate. With the completion of the schemes for developing hydro-electric power and the installation of new thermal plant, the demand for electric motors will increase appreciably.

Expansion

In both the private and public sectors, there is evidence of progress. Some idea of its pace can be had by study of the programme formulated by the Planning Commission, progress during recent years and possible future developments :

Programme of Development

	1950-1	1955-6
Number of units ...	10	12
Annual rated capacity '000 h.p. ...	149.5	300.0
Actual production '000 h.p. ...	99.0	320.0
Estimated requirements '000 h.p. ...	200.0	320.0

In other words, a doubling of capacity and an increase in production by about 223 per cent were envisaged.

Progress during 1951-4

(Unit of measurement '000 h.p.)

Annual rated capacity	...	...	1952-4	200
Actual production	...	...	1951-2	154
			1952-3	160
			1953-4	161

From 10 units with a capacity of 1,49,000 h.p. in 1950-1, the industry has expanded to 12 units with an aggregate annual capacity of about 2,00,000 h.p. Expansion was somewhat facilitated by the improved supply position of raw materials, both home and imported, particularly steel and pig-iron.

Development has not been confined to increase in capacity and output ; new ranges of manufacture were established each year. For instance, in 1952 the production of three-phase A.C. electric motors of 70 h.p. was achieved ; and in 1953 the manufacture of squirrel-cage motors up to 135 h.p. became possible, and that of special types of motors required for the textile industry was begun. A.C. three-phase induction motors up to 225 h.p. are now being produced in this country.

Three units, it is reported, are in the process of expansion, which when completed should provide an additional capacity of 50,000 h.p. to 75,000 h.p. per annum. Two schemes for new units and one further scheme of expansion, which will increase capacity by 82,500 h.p. per year, have been approved by the Government ; by 1955-6, when they are completed, total capacity was expected to be between 3,55,000 and 3,80,000 h.p. against the Planning Commission estimate of 3,00,000.

Until these plans materialize the country will have to depend on imported supplies to meet its needs in respect of electric motors of higher horse-power and of special types required by various industries.

To fill the gap between estimated demand and indigenous production, the Planning Commission suggests that, apart from completion of the Government project under implementation, further increase in capacity should, as far as possible, be achieved in the private sector through expansion and diversification of lines of manufacture—i.e. the manufacture of fractional h.p. motors and special-purpose motors not being carried out in India should be taken up—and that should there, even then, be a gap between estimated demand and indigenous production, it should be covered by imports.

Expansion under way is at a rate much higher than was at one time expected. In early 1953, it was thought that capacity in 1955-6, expansion notwithstanding, would be short of demand by about 20,000 h.p. ; and it was suggested that the difference between future production and demand should be narrowed considerably by some of the units working

two shifts instead of one'. The indications now are that capacity will be well above estimated demand.

The industry hardly existed in 1939 and its growth has been rapid. With the improvement in the raw material position, progress is likely to be accelerated. The industry is being expanded to meet all the country's requirements in electric motors and the more enterprising units are increasing and diversifying production.

Electric Transformers

In the transmission and distribution of electric power, the electric transformer is an indispensable item of equipment.

The industry started on a small scale in 1936-7. The first transformer factory to be established was the Government Electric Factory at Bangalore which produced before the war approximately 6,000 kVA.¹ of transformer.

During the war imports declined and demand increased. The latter was largely due to expansion of ordnance factories and increased availability of electric energy. The following factories were established: Crompton Parkinson Works Ltd., Bombay; Associated Electrical Industries Manufacturing Co. Ltd., Calcutta; and Kaycee Industries, Lahore. Production increased, as these figures show:

Year	Quantity	Value Rs
Pre-war	... 60	60,000
1942	... 200	2,00,000
1943	... 600	6,00,000
1944	... 1,500	15,00,000

Control by the Government, although indirect, was effective. It was in the form of release of raw materials imported and indigenous—especially copper wire.

By 1946 the industry had an annual capacity of 78,000 to 84,000 kVA. per year, the bulk of this confined to ratings up to 250 kVA. and 11 kV.² on the high-tension side. Since 1947 production has been steadily increasing. The table below is a summary of the progress made.

	1950	1951	1952	1953	1954
No. of Units	5	6	7	8	8
Capacity (kVA.) ³	2,75,000	3,00,000	3,04,000	3,28,000	3,28,000
Production (kVA.)	1,71,355	1,74,400	2,14,950	3,08,084	3,98,224

¹ kVA. : kilovolt-ampere, the measure of apparent power in a practical circuit.

² kV. : kilovolt, the practical unit of measuring electromotive force.

³ On a single-shift basis.

Production

It will be seen that although production has not caught up with installed capacity, it has kept pace with the increase.

About 53 per cent of the total requirements of raw materials is imported. And supply has not always been regular and adequate, with the result that production sometimes has had to suffer. It is believed that this dependence on imported supplies of raw materials is capable of being reduced; and there is evidence of efforts to find indigenous sources of supply.

It seems that the rates of import duty on raw materials and components are higher than those on finished transformers. The industry considers it has a strong case for redress. The matter has been referred to the Tariff Commission for inquiry.

The industry is in the hands of specialists and does not seem handicapped, as several others are, by any major technical deficiency. A handicap, however, is the lack of testing facilities. There is great need for a fully equipped testing laboratory.

Expansion

Towards the middle of 1952, the Planning Commission formulated the following programme of development :

	1950-1	1955-6
Number of units	7	9
Annual rated capacity ('000 kVA.)	370.0	485.0
Actual production ('000 kVA.)	178.9	450.0
Progress during 1951-4 is summarized below : (Unit of measurement : kVA. '000.)		
Annual rated capacity	1953-4	328
Actual production	1951-2	202
	1952-3	231
	1953-4	327
April 1954	26.6	
May 1954	32.3	

(The capacity was reassessed by the Development Wing in 1953-4.)

Almost every year, new ranges of production were established. For instance, during 1952-3, manufacture began of transformers with 33 kV. on the h.t. side and 1,500 kVA. rating; in 1953-4, manufacture reached 2,000 kVA. capacity with 33 kV. on the h.t. side.

There has been a steady increase in production. Yet, except for 1953-4, output has been far below capacity. Manufacturers have ascribed this to lack of orders, but perhaps the difficulty in getting raw materials was partly responsible. A large proportion had to be im-

ported; supplies from abroad were not always adequate, and import formalities impeded procurement. Progress in the manufacture of such materials in India had made little headway, and quality was not always satisfactory. Consumers had cause to complain. Latterly, however, there has been some improvement. Domestic production of materials of the quality required is being undertaken, and there has been a quickening and broadening of import licensing.

Imports

The table below gives some indication of the extent of imports pre-war :

1934-5	...	...	Rs 12,90,145
1936-7	...	...	„ 19,66,052
1938-9	...	...	„ 25,22,716

Statistics of imports by types and ratings are not available.

During the war imports declined. From Rs 19,00,763 in 1940-1, they fell to Rs 12,44,309 in 1942-3.

Imports in the last few years have been : 1948-9, Rs 1,09,98,258 ; 1949-50, Rs 1,41,37,644 ; 1950-1, Rs. 1,50,54,661 ; 1951-2, Rs 1,44,55,215 ; 1952-3, Rs 1,44,24,851 and 1953-4, Rs 1,94,23,582. The increase in imports is ascribed to progress in industrialization. Supplies have in the main been from the U.K. and the U.S.A.

Under the Indian Tariff (Second Amendment) Act, 1953, tariff protection has been granted to the manufacture of power and distribution transformers up to 2,500 kVA. and 37.5 kV. on the h.t. side (primary voltage being 250), excluding furnace, rectifier and flameproof transformers, up to 31 December 1955. The protective duty is 10 per cent *ad valorem*.

On the ground that 'there are no scarcity conditions visible', the Planning Commission assumes that production of lower ratings is adequate. The demand is largely for transformers of higher ratings.

Of late, the demand for transformers of small rating (e.g. 15 kVA. and 25 kVA.) has risen, largely because of the increasing need for power supply to tubewells for irrigation purposes.

Assessment of future demand is again far from easy. There is, for instance, as mentioned above, the increasing demand for lower ratings for use with tubewells. The projected expansion of power supply during the Plan period, estimated by the Tariff Commission at 26,50,000 kVA., has to be reckoned with. Account has also to be taken of the demand for replacements; and hardly less relevant is the possible demand from some private industrial undertakings who generate their own power. Understandably, therefore, estimates vary. As with

electric motors, a reassessment of demand seems essential if planning is to be at all fruitful.

Expansion contemplated, and partly already under way, is expected to raise total capacity to 6,77,000 kVA. per year as against the target under the Plan of 4,85,000 kVA. by 1955-6 ; and some of the approved schemes envisage raising the maximum rating to 10,000 kVA. when in full production, as against 2,000 kVA./33kV. so far produced.

It should be possible, if the programme of development is properly implemented, to meet from home production a substantial portion of the country's requirements. Indeed it should be possible to export to countries in South-East Asia where schemes of power development are either under way or investigation ; those markets can be had and held if quality and price are competitive.

Progress in the public sector is summarized below :

	Production			Target for capacity
	1951-2	1952-3	1953-4	
Government electric factory, Bangalore transformers (kVA.)	36,534	24,759	34,993	80,000

Dry Batteries

Dry cell batteries have diverse uses. They are needed for flash-lights, radio sets, electrical appliances, and telegraphic equipment.

The industry was started in India before the war. The Everready Co. of Britain was the first manufacturer, setting up a factory in 1926 at Narkeldanga, Calcutta. The National Carbon Co. (India) Ltd. acquired the factory some years later. Estrela Batteries Ltd. started production in Bombay in 1936.

Annual output before the war was about 18 million cells ; and it is believed, for statistics are not available, that capacity was not very much larger. Demand, however, was much more than the industry could meet. Imports were large.

During the war imports declined and demand increased. The Government therefore decided to assist factory expansion. The National Carbon Co. put up new assembly lines and Estrelas procured a completely new plant. Manufacturers were brought under the statutory control of the D-G.M.P.¹ and their entire output was taken over by the Government. From about 18 million cells per year before the war production reached 132 million cells in 1947.

¹ Director-General of Munitions Production.

The progress of the industry after the war has also been fairly rapid. The table below is a summary :

	1947	1951	1952	1953	1954
No. of Units	3	3	4	5	5
Capacity (millions)	132	184.5	196.5	221.5	221.5
Production ⁶ (millions)	87.9	144.2	130.2	148.4	148.6

Raw Materials

As with the other industries in the light engineering group, the principal problem facing manufacturers of dry batteries has been their dependence on imports of raw materials. The chief materials required for manufacture are manganese dioxide, graphite and carbon rods. The industry uses both indigenous and imported materials. In 1947 the ratio was 22 per cent indigenous and 78 per cent imported. The situation has improved since, but not substantially. Seemingly, though imports cannot be avoided entirely for some time to come, there is likelihood of self-sufficiency in some materials, e.g. ammonium chloride, zinc chloride, chipboards, pulpboards and corrugated cardboard. The manufacture of sealing compounds from local raw materials has started, and the production of manganese dioxide from Indian ore is planned.

The Tariff Board recommended in 1950 that manufacturers, in conjunction with the Council of Scientific and Industrial Research, should explore possibilities of utilizing indigenous raw materials. This was followed by a recommendation by the Tariff Commission in 1953 that 'the industry should make fuller use of the facilities offered by the Council of Scientific and Industrial Research with a view to increasing the utilization of indigenous materials.'

There has been a gradual change-over from manual to mechanical processes of manufacture. Automatic machinery is supplanting obsolete equipment.

The Tariff Board (1947) recommended that the customs duty of 10 per cent on battery manufacturing machinery should be refunded. In October 1948, the Government of India reduced the customs duty on all imported machinery from 10 per cent to 5 per cent *ad valorem*.

Another important recommendation was that the industry should produce radio batteries of the requisite quality on a larger scale.

Quality varies from company to company. Not all brands are as good as imported batteries. The Tariff Board has recommended that manufacturers should conform to the specifications laid down by the Indian Standards Institution.

The industry asked for priority in the movement of raw materials and finished products. The Tariff Board (1950) suggested that this question should be taken up with the railway administrations concerned.

Distribution is through a quota system. Dealers obtain their quota at list prices published by the manufacturers. There is practically no control of prices. To this may be traced the varying and, at times, the high charges made by dealers and retailers. The Tariff Board (1950) recommended—and the Planning Commission has endorsed this recommendation—that a more efficient system of distribution should be evolved so that batteries might be available to consumers at reasonable prices.

Imports

Indigenous production being insufficient to meet demand before the war, imports were large, and came principally from the U.S.A., Germany, Hong Kong and Britain.

During the war, there were practically no imports and requirements were met by indigenous manufacture. After the war, imports were controlled, licences being given only to the extent necessary to relieve shortage.

It was agreed at the Tariff Board inquiry in 1947, that the Indian industry needed protection; that for some time at least the U.S.A. should be treated as the principal competing country; and that the measure of protection should be based on the competition offered by that country. The Board recommended that the industry should be protected till 31 March 1950; and that the existing 30 per cent *ad valorem* revenue duty should be converted into an equivalent *ad valorem* protective duty valid up to the end of March 1949. The Government accepted the recommendation. The Tariff Board (1950) recommended that the protective duty of 30 per cent *ad valorem* should be continued till 31 December 1952.

Tariff protection, originally granted in April 1948, has been withdrawn since January 1954 on the ground that the measure of protection needed by the industry was less than that offered by the normal revenue duty, and that the domestic industry is not exposed to any threat of foreign competition under the present import policy.

Imports of dry batteries for torch lights are now not permitted. Hearing-aid batteries and diaphragms for electrolytic cells can be imported. They are under OGL.

The value of imports in the last few years have been: 1950-1, Rs. 16,99,948; 1951-2, Rs. 24,25,927; 1952-3, Rs. 16,84,121; and 1953-4, Rs. 15,31,414.

Demand and Production

Indian demand before the war was about 40 million cells per year. Demand in 1944 was estimated at about 101 million cells. The Tariff Board (1947) forecast demand during 1947-50 at about 150 million cells per annum. In 1950 the Tariff Board, allowing for the partition of the country, assessed demand for the three years 1950, 1951 and 1952 at 180, 200 and 220 million cells respectively.

As against these estimates, actual demand, as represented by the sum of home production and imports, was 131.6 million in 1948-9; 170 million in 1949-50; and 147.5 million in 1950-1.

Output has been far short of capacity, chiefly because of the low level of demand. The establishment of new units does not seem desirable in the circumstances, and indeed is not likely. In 1953, the Tariff Commission recommended that 'all the three units which are at present in regular production should be given adequate opportunities to supply Government requirements.' Offtake was expected to increase to 320 millions by 1955-6, spread as follows :

Flash-light batteries	...	175 millions
Defence	...	25 "
Radio	...	100 "
Export	...	20 "
Total		...
		<hr/> 320 millions <hr/>

Development planned for the industry is detailed below :

	1950-1	1955-6
Number of units	...	4 5
Annual rated capacity (millions)	...	285 310
Production (millions)	...	136.5 320

It will be noticed that the target for production is higher than that for capacity. Work on more than one shift was contemplated.

During 1953-4, the manufacture of layer-built batteries commenced; and new schemes for the manufacture of dry cells matured and went into production. Progress during 1951-4 is summarized below :

Annual rated capacity (millions)	...	1950-1	285
"	...	1953-4	222
Actual production (millions)	...	1950-1	137
"	...	1951-2	146
"	...	1952-3	125
"	...	1953-4	153

The decline in capacity from 285 millions in 1950-1 to 222 millions in 1953-4 does not denote large-scale closure of units. Capacity was re-assessed by the Development Wing during 1953-4.

Research is under way to design batteries of longer life and less weight.

Exports

The development programme envisaged export of about 20 million dry batteries from the 320 millions expected to be produced by 1955-6. Markets in several South-East Asian and Middle East countries have been established. Exports during recent years have been :

Year		Quantity	Value (Lakh Rs)
1950	...	85,193	0.20
1951	...	1,445,673	2.58
1952	...	1,114,966	2.92

Further widening of the export market seems possible ; and the process could be accelerated by improving the quality and reducing the price of the Indian product. Standards are under study ; economy in the utilization of raw materials and the improved methods of manufacture may lead to a reduction in prices. The Planning Commission has recommended that 'efforts should be made to step up exports and that the Government might consider the inclusion of cells in bilateral trade agreements with neighbouring countries.'

'With a view to stimulating exports,' the Commission adds, 'the Government may also consider the possibility of granting remission of import duty on raw materials actually consumed for the manufacture of cells for export.'

Storage Batteries

Storage batteries are used mostly in motor-cars.

The industry started in India long before World War II. There are reports of manufacture as early as 1931 by the Tropical Accumulators, Calcutta. The two main units before the war were Amco Ltd., Bangalore and the Estrela Batteries Ltd., Bombay. Production was not equal to demand, the bulk of which was met by imports. Representative import figures were : 1931-2, Rs 8,54,768 ; 1934-5, Rs 7,50,027 ; 1936-7, Rs 6,37,910 and 1938-9, Rs 6,95,086. Supplies were mostly from the U.K., Germany, France, Belgium and the U.S.A. The gradual fall in imports is significant.

During World War II there was simultaneously a decline in imports and an increase in demand. Existing manufacturers expanded opera-

tions. Several new units came into existence. Four producing units were brought under the statutory control of the D-G.M.P. for production and distribution. Control came into operation in September 1943 and terminated towards the end of 1945. The Government gave all possible assistance to the industry, e.g. import licences for raw materials, additional equipment, etc.

The statement below summarizes progress in the years 1947-54 :

	1947	1949	1951	1953	1954
No. of units	7	12	11	14	13
Capacity (Nos)	1,72,000	2,68,000	3,18,000	3,50,100	2,90,100
Production (Nos)	70,028	1,07,065	2,12,400	1,75,999	1,88,400

(The General Motors [India] Ltd. unit closed operations in 1954.)

The total investment in the industry is estimated at Rs 2 crores.

The number of workers including technical personnel is about 1,700.

Raw Materials

The two main types manufactured are the lead-acid and the alkaline.

Production has not been up to full capacity. This, the industry contends, has been largely due to irregular and inadequate supplies of raw materials.

The industry depends on imports for several of its more important raw materials, i.e. lead, asbestos fibres, veneers and containers. The Planning Commission recommends that firms in the country, which are capable of producing about 3,00,000 containers, should be suitably assisted so that dependence on imports may be avoided; that in regard to home production of battery separators, efforts should be concentrated on evolving Indian substitutes; and that in the case of raw materials such as sulphur, lead, etc., whose production cannot be developed for diverse reasons, adequate stocks should be built up to ensure regular supplies. Present difficulties over veneers produced in India, it is reported, relate to the quality of timber and machining problems arising from it.

In recent years, there has been much progress in production within the country of some of the essential raw materials and components for the manufacture of storage batteries. For instance, the manufacture of refined lead and microporous rubber separators has commenced. Self-sufficiency, however, has not yet been reached. Imports continue.

The Tariff Board reported in 1948 that indigenous motor vehicle batteries were satisfactory in quality and that, given a steady supply of raw materials of the right quality, Indian manufacturers could turn out batteries as good as the imported article.

Initially there was prejudice against the Indian product. This is slowly disappearing, and the Government has helped by placing the

bulk of its orders with home manufacturers. The prescription of standards by the Indian Standards Institution for the finished product and some of the components, although tentative, is said to have 'killed consumer prejudice'.

Imports

To promote home manufacture, imports were restricted to certain special types, and hence have been small. The classifications made in Trade Accounts are far from clear. The average per year of imports of batteries and their parts during the years 1951-4 has been only about Rs 27.6 lakhs in value.

The industry's case for protection was considered by the Tariff Board in 1948. The Board recommended that a protective duty of 80 per cent *ad valorem* should be imposed on imports of motor vehicle batteries (including batteries which are interchangeable for automobile purposes on the one hand, and radio, telephone and telegraph on the other) and plates for such batteries; that the duty should remain in force for three years; and that continuance of quantitative control on imports, though it might be necessary for conserving foreign exchange, would not be required as a means of protecting the industry. The Government accepted the recommendation, and the protective duty came into operation on 4 November 1948.

The Indian Tariff (Second Amendment) Act, 1950 extended the protection up to 31 December 1951 and subsequently the Indian Tariff (Amendment) Act, 1952 extended it up to 31 December 1952. Since then, another inquiry has been held, this time by the Tariff Commission.

The Government accepted the Tariff Commission's recommendation that the protection should be continued for a period of three years ending 31 December 1955. In accordance with the recommendations of the Tariff Commission, the rate of duty levied on batteries for motor vehicles and plates for such batteries has been reduced from 80 per cent *ad valorem* to 42½ per cent *ad valorem* where the products are of British manufacture, and from 83 per cent *ad valorem* to 45 per cent *ad valorem* where the products are not of British manufacture.

Demand

Annual demand before the war was about 60,000. It increased during the war. Accurate statistics of the extent of increase are not available. In 1948, annual demand was estimated at about 2,50,000 batteries.

Towards the middle of 1952, examining the affairs of light engineering industries, the Planning Commission estimated demand at the time

for motor vehicle batteries at 3,00,000 to 3,50,000 per year. Future requirements are difficult to forecast, but it was presumed that they would be about 4,00,000 by 1955-6. As capacity by then would be adequate to meet requirements, the establishment of new units is not contemplated.

To meet this demand, expansion and diversification of production is in progress. The number of units has increased from 11 in 1948 to 13. Present total annual installed capacity is estimated at about 2,90,100. It has nearly doubled since 1947; and production has registered well over a 100 per cent increase. Apart from increase, there has been diversification of production. At a meeting convened by the Planning Commission in October 1951 to discuss the development programme of light engineering industries, it was agreed that the production programmes of existing units should be diversified so that dependence on imports for special types of batteries might be reduced to a minimum at the end of the planning period.

Exports

There are no restrictions on exports, though these seem to be still on a very limited scale (accurate figures are not available as exports of storage batteries are not recorded separately in trade accounts) due largely perhaps to competition from foreign batteries. South-East Asian countries seem promising markets. A report from the Indian Trade Representative in Ceylon reads:

'A good market can be established by supplying batteries at competitive prices. As Indian batteries are not sufficiently known in Ceylon, suppliers should give their products organized publicity and at the same time appoint local agents who should be also in a position to maintain service stations for attending to repairs.'

Expansion

The industry is working to the following programme of development.

	1950-1	1955-6
Number of units	13	19
Annual rated capacity	4,45,820	5,38,420
Actual production	2,00,000	4,00,000
Estimated requirements for domestic consumption and exports	2,50,000	4,00,000

The table below summarizes progress during 1951-54:

Storage Batteries ('000)

Annual rated capacity	...	1950-1	446
" " "	...	1953-4	350
Actual production	...	1950-1	200
" "	...	1951-2	212
" "	...	1952-3	136
" "	...	1953-4	179

(Note : The rated capacity was reassessed by the Development Wing during 1953-4.)

The decline in production in 1952-3 is attributed to the set-back in the automobile industry.

Several new types, such as motor cycle batteries and heavy duty batteries required for use in omnibuses, heavy trucks, electrically driven equipment, marine engines, aircraft and tractors, are now increasingly being manufactured in the country. Railway requirements are also being met from home production. Apart from the expansion of the main industry, there has been a development of ancillary lines, such as the production of containers, lead oxides and separators. Schemes for two units for the manufacture of dry-charge batteries, iron-clad batteries, heavy duty and traction batteries have been approved by the Government.

Electric Wires and Cables

The production of electric wires and cables in India before the war was small. The bulk of the country's requirements was met by imports. A few representative statistics are given below :

Imports—Wires and Cables

1934-5	...	Rs	30,79,618
1936-7	...	Rs	31,97,682
1938-9	...	Rs	1,32,00,000

During the war imports declined and demand increased. Indian units increased production and producing units were brought under the statutory control of the D-G.M.P. The Government regulated the supply of raw materials to manufacturing units and assisted the industry in obtaining copper rods. The import duty on the commodity was abolished.

The statement opposite summarizes progress during the years 1947-54:

		1947	1949	1951	1952	1953	1954
Cables & Wires							
(a) Bare Copper							
Conductors :							
No. of Units	...	2	2	2	20,000 tons	20,000 tons	27,800 tons
Capacity	...	24,000 tons	24,000 tons	20,000 tons	5,929 tons	7,372 tons	7,576 tons
Production	...	Not available	5,723 tons	2,820 tons			⁵
(b) Winding Wires :							
No. of units	...	2	2	2	2	2	2
Capacity	...	300 tons	400 tons	450 tons	450 tons	450 tons	450 tons
Production	...	Not available	340 tons	285 tons	398 tons	226 tons	318.59 tons
(c) Rubber Insulated Cables & Flexibles :							
No. of units	...	2	2	2	2	2	4
Capacity	...	50 million yds	50 million yds	45 million yds	45 million yds	45 million yds	86.84 million yds
Production	...	Not available	19 million yds	41.58 million yds	32.86 million yds	48.43 million yds	62.72 million yds
(d) Aluminium							
Conductors :							
No. of units	...	—	—	—	—	3	3
Capacity	...	—	—	—	—	6,620 tons	9,020 tons
Production	...	—	—	—	—	3,280 tons	5,481 tons

Raw Materials

Among raw materials available in India are : electrolytic copper rods, electrolytic aluminium rods, antimony, copper wires, paper and paper boards, textiles and yarn, varnish, rubber smoked sheets and rubber pale crêpe, rubber, chemicals (including French chalk, China clay, red lead and soft soap). Lead ingot, tin ingot, galvanized sheet wire, paper and paper board, textiles and yarn, polyvinyl chloride, polythene, Chattertons compound, and some chemicals are imported.

About 74 per cent of the raw materials are obtained from Indian sources and the balance is imported. According to technical opinion it should be possible to increase the percentage of indigenous supply and reduce imports by scientific research and diversification of production. Such a course, it adds, will lend additional stability to the industry.

Machinery is mostly imported.

Manufacture is now according to British standard specifications. Indian standards are under preparation by the Indian Standards Institution.

Imports

Imports of cables and wires in recent years have been as follows :

	1951-2	1952-3	1953-4
	Rs	Rs	Rs
Rubber insulated cables	52,56,683	78,04,373	97,12,342
Insulations other than rubber ...	2,50,40,284	6,07,60,957	4,77,30,313
Telegraph and telephone wires and cables ...	3,45,580	10,16,925	96,28,006
Bare copper wire ...	37,40,977	11,57,727	48,29,790
Total ..	3,43,83,524	7,07,39,982	7,19,00,451

Demand

Wires and cables have a wide range of usefulness. In India, wires are used mostly as conductors of electricity in one form or another ; and cables, for long-distance power transmission.

Home demand for the different types is difficult to determine for two reasons : the quantities imported, as apart from value, are not recorded ; and the extent to which aluminium will take the place of copper in cable manufacture will depend largely on the relative availability and price of the two metals. That demand will grow

in the next few years there is, however, little doubt, for with the increase in the rate of electricity generation, the completion of the various multi-purpose projects and housing schemes, and the expansion of the electric fan, motor and transformer industries, more cables and wires will certainly be required. The Planning Commission estimated that by 1955-6 annual requirements for the various items would be as follows :

Bare copper conductors	...	10,000 tons
Winding wires	...	1,875 tons
Rubber insulated and plastic cables and flexibles	...	105 million yards.
A.C.S.R. cables	...	8,000 tons

Exports have been negligible. Trade Accounts showed Rs 4,699 for 1952-3.

Expansion

The principal developments are an expansion of capacity in the private sector and the establishment of a dry-core cable factory in the public sector.

The industry has been working to the following programme of development :

	1950-1	1955-6
Number of units	4	5
Annual rated capacity :		
(1) Telegraph and telephone wires and cables (million ft.)	Nil	2.5
(2) A.C.S.R. cables (tons)	2,500	5,000
(3) Insulated aluminium conductors (tons)	Nil	500
(4) Winding wires (tons)	450	1,100
(5) Rubber and plastic insulated cables and flexibles (million yds.)	65	119
(6) Paper insulated power cables (miles)	Nil	400

Progress during the years 1951-4 has been :

Annual Rated Capacity (tons)

Cables and Wires—A.C.S.R. Conductors	1950-1	2,500
—do—	1953-4	6,620

Actual Production

	Year.	
Bare copper conductors (tons)	1950-1	4,963
" " "	1953-4	6,293

	Year.	
Winding wires (tons) ...	1950-1	254
" " " "	1951-2	358
" " " "	1952-3	383
" " " "	1953-4	156
Bare copper conductors (tons) ...	1952-3	7,522
Rubber insulated cables and flexibles		
(million yards) ...	1950-1	39.3
" " "	1951-2	41.3
" " "	1952-3	36.2
" " "	1953-4	48.6
A.C.S.R. cables *	1950-1	1,420
" " "	1951-2	1,720
" " "	1952-3	2,381
" " "	1953-4	3,280

* Figures relate to calendar years.

For A.C.S.R. cables, an increase in capacity to 13,000/14,000 tons per annum is contemplated. Capacity in 1953-4, it will be seen, was assessed at 6,620 tons, i.e. 1,620 tons higher than the target for 1955-6.

The expansion plans of one of the more important units envisaged 'increase in the capacity and output of two items already under production' and commencement of manufacture of 'four new items' at an estimated cost of Rs 2.8 crores. So far established are one new rod mill with an annual installed capacity of 6,700 tons of black copper and aluminium rods and 'additional capacity for about 100 tons of cotton and paper covered wires and for 3 million yards of plastic insulated cables and flexibles per annum.' Work on the installation of plant for the production of other items is reported to be in progress.

Expansion, it is estimated, will cost the industry about Rs 317.5 lakhs in all.

Assistance, to the extent of about Rs 198 lakhs so far, has been had from the Industrial Finance Corporation in the form of loans.

In view of the dependence on imports for raw materials, the Planning Commission does not recommend any further expansion in productive capacity beyond what is expected from schemes under implementation and the Government project for dry-core cable manufacture.

The dry-core cable factory, which went into production in July 1954, is a project to which the Government attaches great importance. It is designed to produce annually about 470 miles of cable length of

different specifications. The intention is to make the country independent of imports of telephone cables, which now cost nearly Rs 1½ crores per year. Capacity installed is said to be sufficient to produce, on a single-shift basis, nearly 500 miles of telephone cables of different sizes per year.

It will be seen that output generally has been rising, though not with the same steepness as capacity. Any minor recession that there has been reflects either the shortage of raw materials, the bulk of which has still to be imported, or a decline in demand.

Electric Lamps

The first step towards the manufacture of electric lamps in India was taken in 1932 when the Bengal Electric Lamp Works Ltd., Calcutta, started a factory to produce electric lamps. Actual production, however, did not begin until late in 1934. Since then, the industry has expanded considerably.

Average annual production before the war was about 2½ million and demand about 14 million bulbs. The difference was met by imports. Supplies were mostly from the U.K., the Netherlands, Japan and the U.S.A.

During the war demand increased. Statistics of the extent of increase are not available, but it is clear that it was made up mostly of the requirements of factories engaged in war work. Imports from the continent and Japan stopped and those from the U.K. and U.S.A. diminished. Indian production increased. The figures for 1942, 1943 and 1944 are : 3.75 million, 3.85 million and 5 million respectively. The Government exercised control over production and distribution through the Director-General of Munitions Production.

The beginning of 1947 saw a total capacity of 13 million lamps accounted for by nine units, thus registering an increase of about 8 million during the war. The table below summarizes progress in 1947-50 :

	1947	1948	1949	1950
No. of units	9	10	10	10
Capacity (Nos.)	13 million	14.35 million	18 million	23 million
Production (Nos.)	7.62 million	9.25 million	13.6 million	14.3 million

The position of the industry in 1950 is summarized below :

(Average per factory : all sizes)

Number of factories (A)	8
Range of employment	1 to 505
Fixed capital in plant and machinery	Rs 5,76,000
Employees	201
Input of man-hours (B)	Rs 4,57,000
Labour cost (C)	Rs 2,61,000

Material cost (D)	Rs 6,19,000
Value of products	Rs 11,93,000
Value added by manufacture (E)	Rs 5,73,000

- (A) Excluding closed factories.
- (B) Including estimated man-hours of salary earners as well.
- (C) Including wages, salaries and non-cash benefits.
- (D) Excluding depreciation.
- (E) Depreciation not excluded.

Production

In 1951, although installed capacity continued to be the same as in 1950 (i.e. 23 million), production increased to about 15.15 million. In terms of percentage, the expansion that had taken place by the end of October 1951, based on the monthly average for 1946—the first after the war period—is 96.1. In 1952, miniature electric lamps and electric lamps of 1,000 watts were for the first time manufactured in this country.

Progress during the years 1952-4 is summarized below :

Year	Unit	Factories	Capacity	Production
1952	No.	11	2,60,00,000	2,08,81,831
1953	"	11	2,90,00,000	1,97,76,000
1954	"	11	2,90,00,000	2,98,60,000

There are, thus now 11 units manufacturing general lighting service lamps with a capacity of 29 million lamps per year as against 10 units with a capacity of 23 million lamps in 1950-1. The establishment of new units does not seem likely ; and indeed may not be permitted by the Government.

Raw Materials

In retrospect, it is not surprising that the industry made a beginning in Calcutta and its suburbs. This area has singular advantages over many others, and manufacturers were not slow to perceive them. The more important are the presence of scientific research laboratories, the existence of glass factories, availability of cheap electricity and gas, proximity to markets and availability of skilled labour.

The industry is dependent on imports for most of its raw materials and components. Of these, the more important are : glass tubings and rods, chemicals, tungsten wires and coiled filaments, molybdenum wire, solder wire (multi-rosin cored), capping cement, argon and nitrogen gases, leading-in wire, brass caps and steel mandril wire.

Among suggestions to improve the supply situation have been : the

establishment of a central glass factory capable of blowing 1,00,000 bulbs and an adequate quantity of tubes per day to enable manufacturers to get their full supply of bulbs from Indian sources ; the installation of automatic machines in existing factories for blowing bulbs ; installation of a big brass cap manufacturing plant capable of meeting fully the demand of all the lamp factories for brass caps ; establishment of a filament factory at a place where the aid of established scientific laboratories is available ; and the import of equipment for manufacture of electrodes and other resistance wire.

The principal problem facing the electric lamps industry has been the procurement of the right type of raw materials. Till recently the bulk of requirements were imported. In the last few years, in pursuance of a recommendation by the Planning Commission, some items have been manufactured here, such as brass lamp caps for general lighting service lamps. The production of glass shells is being expanded to meet the industry's requirements in full. Again in accordance with the Planning Commission's recommendation, imports of such items as India cannot, for the time being, produce, has been liberalized. Even so, production, although increasing, has been much below capacity ; largely because the establishment of ancillary feeder industries has been necessarily slow, and supplies of raw materials from abroad were not readily forthcoming.

Imports

Imports before the war averaged Rs 30 lakhs. Figures are given below for four years :

Years	No.	Value (Rs)
1935-6	2,48,87,302	39,87,676
1936-7	2,29,47,991	33,02,306
1937-8	2,73,83,011	39,76,046
1938-9	1,89,45,228	28,01,396

During the war there was a decline in imports :

Years	No.	Value (Rs)
1940-1	1,97,95,779	21,57,146
1941-2	2,56,83,624	26,09,281
1942-3	42,40,649	18,77,722
1943-4	26,70,536	15,16,742

Imports during the years 1948-51 were :

	1948-9	1949-50	1950-1
	Rs	Rs	Rs
Gas-filled electric bulbs	26,65,246	32,33,742	6,26,529
Vacuum electric bulbs	12,91,863	12,33,113	66,848
Electric lamps, other sorts	95,38,349	1,64,24,466	27,87,984

Supplies were mostly from Britain and the U.S.A.

The increase in home production of the several types of lamps is partly reflected in the import statistics for the three years given below :

	1951-2		1952-3		1953-4	
	Quantity (Numbers)	Value (Rs)	Quantity (Numbers)	Value (Rs)	Quantity (Numbers)	Value (Rs)
Electric lamps and parts thereof	99,28,265	32,04,714	56,93,323	19,80,537	25,835	13,052
Electric bulbs for torches	2,10,52,709	27,02,881	1,97,24,439	18,98,999	1,91,53,400	18,01,451
Electric lamps, other sorts	5,89,142	16,48,315	15,63,280	28,80,961	20,73,532	28,09,049
Parts and accessories of electric lamps	—	6,92,617	—	9,66,728	—	7,00,830
Flash-lights or torches and parts thereof	—	48,57,026	—	73,20,825	—	54,72,035

Of exports, either by land or sea, there is no record in the country's trade accounts for 1952-3 and 1953-4.

Early in 1953, the Planning Commission formulated the following programme of development :

G. L. S. LAMPS¹

	1950-1	1955-6
Number of units	10	12
Annual rated capacity (million numbers)	23	32.5
Production (million numbers)	15.0	30.0
Estimated requirements (million numbers)	16.00	30.0

MINIATURE LAMPS

Number of units	1	8
Annual rated capacity (million numbers)	0.9	27.5
Production (million numbers)	...	16.0

¹ G. L. S. Lamps : general lighting service lamps.

This programme was worked out on the basis of an assessment of the availability of raw materials, capital equipment and manpower, as also the state of demand and the absorption capacity of the market.

The table below shows progress during the years 1951-4

G. L. S. LAMPS

(Unit of measurement Nos. '000)

Annual rated capacity	1950-1	23,000
	1953-4	29,000
Actual production	1950-1	14,000
	1951-2	17,300
	1952-3	20,740
	1953-4	19,800

It will be seen that while the target for capacity has very nearly been reached, that for production is still far ahead.

Much more significant than increase has been the diversification of output. Lamps other than of the G.L.S. type are now being manufactured. Train lighting and some quantities of coloured lamps for decorating purposes are being produced. The manufacture of fluorescent tubes has also been taken up. The production of miniature lamps, such as torch bulbs, radio dial lamps, cycle dynamo lamps, auto bulbs, telephone switch board lamps, etc., also commenced during the last few years.

Quality is reported to be satisfactory. The Indian Standards Institution has prescribed a standard for G.L.S. lamps.

Of demand, as with electric motors and transformers, there are varying estimates. That with which the industry is directly concerned, and incidentally also the latest, is by the Planning Commission. 'Assuming that the rate of increase in the generation of electricity would be the same during the period of the Plan as it is at present (1952-3),' the Commission estimated that 'the requirements of G.L.S. lamps would be of the order of 30 millions by 1955-6 as against consumption in 1950-1 estimated at 15 to 16 millions.' Clearly current capacity is adequate to meet the country's present demand for G.L.S. lamps.

Electric Fans

The first known attempt to manufacture electric fans in India was made in 1922 by the Scientific and Electrical Instruments Manufacturing Company of Calcutta. In 1924 this firm became a limited concern and assumed a new name: The India Electric Works Ltd. Its factory was the first to be run on modern lines.

The success of the India Electric Works Ltd. encouraged others to enter the field. By 1939 there were more than half a dozen firms

manufacturing electric fans ; their total capacity was 40,000 units.

During World War II imports declined. From Rs 18,70,312 in 1939-40, their cost fell to Rs 1,92,973 in 1944-5. But demand increased greatly. To the normal civilian requirement was added that of expanded Government offices, military camps, hospitals and barracks. New fan factories were built, and some old ones expanded their capacity : at one time as many as 75 were in production.

Annual output before the war averaged 30,000 ceiling fans and 5,000 table fans. Production figures for some war years are given below :

Year		Ceiling Fans	Table Fans
1940	...	38,000	6,800
1942	...	38,400	11,000
1944	...	1,05,000	30,000

With the war's end, many of the smaller units closed down. The artificial stimulus of inflated war demands having been removed, they could not compete with well organized manufacturers. By 1949 there were only about 30 firms left and total capacity amounted to about 3,10,800 fans a year. The table below shows their regional distribution :

States	No. of Factories	Annual Capacity	Percentage of total capacity
W. Bengal	17	2,11,800	68.14
Bombay	5	40,800	13.13
Delhi	5	42,000	13.51
Rajasthan	1	2,400	0.77
Punjab and Patiala Union	2	13,800	4.45
Total	30	3,10,800	100.00

The statement below shows the position of the industry in 1950 :

Range of employment	1 to 2,033
Number of factories	27
Fixed capital in plant and machinery	Rs 2,15,000
Employees	211
Input of man-hours	4,51,000
Labour cost	Rs 2,31,000
Material cost	Rs 4,79,000
Value of products	Rs 13,20,000
Value added by manufacture	Rs 8,41,000

The following statement, compiled by the Directorate of Industrial Statistics, Calcutta, summarizes the situation in 1952 :

Item.

1. Number of factories employing 20 or more workers and using power	...	30
2. Average Number of days worked	...	286
3. Productive Capital employed—		
(a) Fixed Capital	...	Rs 93,99,515
(b) Working Capital	...	Rs 1,25,32,485
Total Productive Capital	...	Rs 2,19,32,000
4. Number of persons employed	...	4,917
5. Salaries and wages paid	...	Rs 62,67,913
6. Fuels, Electricity, Lubricants, etc. consumed—		
(a) Quantity—		
(i) Coal	... Ton	207
(ii) Electricity	... kWh.	24,61,485
(iii) Lubricating oils	... Gallon	10,309
(b) Value—		
(i) Coal	... Rs	7,921
(ii) Electricity	... Rs	1,59,886
(iii) Lubricating oils	... Rs	40,103
(iv) Others	... Rs	80,255
Total	...	Rs 2,88,165

7. Materials consumed—

(a) Quantity—		
(i) Steel plates and sheets	... Tons	1,615
(ii) Copper wire	... Tons	130
(iii) Brass	... Tons	111
(iv) Paints	... Cwt.	3,335
(b) Value	...	Rs 1,40,04,200

8. Amount paid to other concerns for work done for factories

9. Production—		
(a) Quantity*—		
(i) Fans	... No	1,54,214
(ii) Components, accessories, etc	... No	40,103
(b) Value		
(i) Fans	...	Rs 2,11,18,190

* The figures exclude the production of electric fans in certain factories which have been classified under other industries, since their principal product is not electric fans.

(ii) Components, accessories, etc.	Rs	6,95,493
(iii) Other products	Rs	37,76,428
Total	Rs	2,55,90,111
10. Amount received from others for work done for them	Rs	1,13,298
11. Value added by manufacture	Rs	1,02,49,477

Production

The table below shows production in recent years :

	1951	1952	1953	1954
No. of Units	19	18	18	18
Capacity (Nos)	2,76,900	2,93,600	3,03,100	3,03,100
Production (Nos)	2,22,800	1,95,600	1,99,468	2,36,780

The gap between capacity and production is attributed to a shortage of raw materials, both imported and indigenous. The Tariff Board suggested that the industry should take up the question of adequate allocation of steel direct with the Government of India. This was done, and the present position is that if indigenous supplies of steel fall short of requirements, manufacturers are permitted to import the quantity needed. But difficulties have been experienced over price and delivery—the first is higher than the Indian rate and the second is uncertain and often delayed. These two factors, the industry points out, have impaired its competitive position in the world market.

During the war, the Government assisted the industry by supplying manufacturers with essential raw materials, imported mostly from the U.S.A. and the U.K. Since 1946, the Directorate-General of Industry and Supply has been assisting the more efficient units to improve the quality of their products.

Attempts are being made to reduce dependence on imports of raw materials. Some ancillary industries are being developed (e.g. ball bearings, insulated cables); and it should now be possible to dispense with imports of a few more of the materials required.

The industry asked for a reduction in the import duties on raw materials. The Tariff Board reported that there was no case for a reduction then but that, when fans of Indian manufacture met with strong competition in the export market, the request should be favourably considered by the Government. The industry has repeated its request.

Towards the beginning of 1953, the Planning Commission formulated the following programme of development for the industry :

	1950-1	1955-6
Number of units	22	18
Annual rated capacity	2,88,000	3,60,000

	1950-1	1955-6
Actual production ...	1,94,100	3,20,000 to 3,50,000
Domestic requirements ...	2,12,000	3,20,000

In other words, capacity was expected to be stepped up by about 30 per cent and production by about 80 per cent, almost to full capacity, by the end of the Plan period.

Progress during the years 1951-4 is summarized below :
(Unit of measurement Nos '000)

Annual rated capacity	1950-1	288
	1953-4	303
Actual production	1951-2	215
	1952-3	189
	1953-4	206

There are now 18 factories in operation with a total annual capacity of 3,03,100 fans. Further expansion is in progress. Schemes for increasing capacity submitted by the Jay Engineering Works (from 22,000 to 1,20,000) and the Jaura Engineering Works (from 1,200 to 2,400) have been approved by the Government; and, when completed, will have increased the industry's total annual capacity to 4,51,000 fans. As the annual installed capacity expected would be in excess of requirements by 1955-6, the Commission does not recommend the installation of new units during the planning period.

The present range of manufacture includes ceiling fans, table fans, railway carriage fans, pedestal fans and air circulators. As present production, except for some special types of fans, is adequate to meet total home requirements, and as capacity is likely to rise to a figure much in excess of probable demand, the establishment of new units is not likely, and may not be approved, for the next few years.

Although there has been improvement, quality continues to cause some concern, especially in the context of current efforts to develop export markets.

Imports

The table below is suggestive of the volume of imports before the war :

1936-7	...	Rs 38,15,896
1937-8	...	Rs 31,07,142
1938-9	...	Rs 25,09,550

The main sources were the U.K., the U.S.A., Germany, Italy and Japan.

During the war, imports from Germany, Italy and Japan ceased. The following figures indicate the decline in imports :

1939-40	...	Rs 18,70,312
1942-3	...	Rs 10,52,987
1944-5	...	Rs 1,92,973

Imports during the years 1946-51 were :

	1946-7	1947-8	1948-9	1949-50	1950-1
	Rs	Rs	Rs	Rs	Rs
U.K.	18,24,371	21,30,965	89,679	2,54,893	2,62,486
U.S.A.	22,582	97,208	64,829	1,633	3,453
Other countries	49,305	3,87,642	57,592	4,27,681	67,451
	<u>18,96,258</u>	<u>26,15,815</u>	<u>2,12,100</u>	<u>6,84,207</u>	<u>3,23,390</u>

The fall in imports—from about Rs 30 lakhs before the war to about Rs 4 lakhs after the war—is significant.

The industry applied for tariff protection in March 1950. The Tariff Board submitted its report to the Government in November 1951. Having regard to the comparative figures of the landed costs of imports, the selling prices of the indigenous product and the quantitative restrictions on imports, the Board considered that there was no case for imposition of any protective duty on electric fans. The Government accepted this view.

Imports of ceiling fans are now not allowed. There is a small quota for other types of fans. Imports (in value) of electric fans and parts thereof in the last few years have been : 1951-2, Rs 5,51,420 ; 1952-3, Rs 4, 46,371 ; 1953-4, Rs 6,83,406 and April to July 1954, Rs 2,31,884.

Demand

In the main, demand has been for two types of fans : the ceiling fan and the table fan.

Demand before the war was estimated at between 60,000 and 80,000 fans per annum. With an improvement in the standard of living and increase in the area electrified, demand is likely to increase. And now that the programme for equipping Class III passenger coaches with fans is to be accelerated, demand will increase.

Production can easily be doubled as capacity for manufacture of each type of fan is inter-changeable. Assuming that the rate of increase in the generation of electricity will be the same as at present, it was estimated that demand would reach 3,20,000 fans (all types) by

1955-6. The industry has established itself and is now in a position to meet a substantial portion of the country's requirements of electric fans.

Exports

The target set for exports in the First Five-Year Plan was 30,000; 3,655 fans valued at Rs 4,87,399 were exported during 1952-3. Figures for 1953-4 are not available, but exports have been on the increase. From April to July 1954, 3,359 fans valued at Rs 4,35,461 were exported. The bulk of exports has gone to countries in South-East Asia, which seems a market well worth developing.

Radio Receivers

Before the war, demand in India for radio receivers was comparatively small. The public had not yet become sufficiently 'radio-minded'. Demand was met almost entirely by imports. The table below shows imports during the years 1936-40 :

Year	Sets Value Rs	Valves Value Rs	Components other than Other Parts	
			Valves Value Rs	Value Rs
1936-7	25,17,442	1,72,055	5,17,698	3,12,876
1937-8	28,11,415	2,11,504	5,95,499	11,01,614
1938-9	26,85,528	1,53,985	3,81,615	9,93,527
1939-40	40,62,138	2,29,835	3,10,992	3,87,037

The situation changed during World War II. By 1941 imports of sets and spares had declined considerably. Army demands had increased; and they were large and urgent. And on the civilian side there was growing recognition of the usefulness of radio receivers for entertainment and education. The Defence Services asked scientific institutions to investigate the possibilities of manufacturing in India as many components as possible. A few firms started manufacture of components like transformers, paper condensers, etc. The increasing demand for sets—it reached a peak (52,416 sets) in 1941-2—accelerated and widened this development. Yet, until 1946, there was no radio-receiver assembling industry of considerable size in India. In 1947 two units with a total installed capacity of about 8,000 sets came into existence. The table below summarizes progress during the years 1951-4 :

	1951	1952	1953	1954
Number of Units	12	15	15	15
Capacity (Nos)	87,200	1,53,100	1,53,100	1,53,100
Production	68,100	71,496	56,270	58,616

There are now fifteen units in operation. Competition is keen. Transmitting sets are as yet neither manufactured nor assembled in India ; requirements are met wholly by imports.

Raw Materials

Of materials for manufacture the following are available in India : wooden cabinets, chassis and hardware. Radio valves, radio components (e.g. condensers, transformers, chokes, resistors, loudspeakers), enamelled copper wires, transformer steel and insulating materials are imported.

These figures, taken from Seaborne Accounts, show the extent of the country's dependence during recent years on foreign sources for component parts of wireless receivers :

	1951-2		1952-3		1953-4	
	Quantity (Number)	Value (Rs)	Quantity (Number)	Value (Rs)	Quantity (Number)	Value (Rs)
Wireless valves	8,01,583	22,63,946	5,67,825	16,31,236	4,37,506	11,03,514
Component parts of wireless receivers other than valves	—	1,16,62,485	—	80,70,785	—	46,73,060

Attempts are being made by the more important firms to manufacture loudspeakers, gramophone pick-ups, record players of radio-grams, various types of condensers, resistors, plastic moulded cabinets, etc.

These imports, which have come mostly from the U.K., the Netherlands and the U.S.A., have been declining in both quantity and value. Even so, assembly rather than manufacture seems the appropriate term to describe the industry's activities. Large-scale producers have begun to manufacture essential components in India, but production is still limited. It is, however, expected that during the next two or three years considerable progress will be made. A factor retarding increased production is the present meagreness of demand for radios. Only when the offtake is very much higher will the manufacture of components be economic.

The import duty on materials is said to be in the main responsible for the high cost of sets. The Planning Commission recommends that the possibility of reducing the duty should receive careful consideration.

Imports

Imports of complete receivers in recent years have been :

Year.	Quantity	Value Rs
1951-2	... 29,121	52,64,017
1952-3	... 19,288	36,09,299
1953-4	... 13,042	23,45,472

These have come mostly from the U.K., the Netherlands and West Germany. Imports are under control ; home production determines the quantum to be allowed.

The Planning Commission is of the view that 'existing units should be given necessary facilities to expand capacity and that the installation of additional units is not necessary during the next five years.'

A large proportion of the personnel has to be highly skilled.

Demand

The total offtake in 1950-1 was 60,012 sets. The total number of radio licences in force on 1 September 1952 was 7,01,638 as against 2,50,000 at the end of 1941. Several State Governments have installed radio receivers in schools. There were in 1952 4,600 community receivers in operation. An increase in this number is expected, as some more State Governments have evinced interest in the development of community listening. All-India Radio's plans for the development of broadcasting in India extend to areas not so far served directly by AIR stations in the region, and contemplate the provision of such services in Rajasthan, Madhya Bharat and Saurashtra.

The Planning Commission estimated that demand would increase to 3.5 lakh sets by 1955-6.

To meet this anticipated demand, the Commission suggests that existing manufacturers who are willing to expand their capacity should be given the necessary facilities to do so ; that qualified and enterprising engineers might be allowed to take up manufacture of quality sets as a means of providing employment to educated unemployed ; and that research should be concentrated on the evolution of cheap sets to popularize radio to an increasing extent. On the ground that quality may suffer, the Commission deprecates undue multiplication of the number of small assemblers.

Future development will depend to a large extent, as the Commission points out, on three factors : availability of cheaper radio sets, increased availability of electric power and an extension of broadcasting services. While aware that if sets were cheaper more would be sold, the industry cannot, apparently, cut prices because of its dependence

largely on imports and raw materials. Increased generation of electricity is, as mentioned earlier, more or less in the offing. In October 1954 the number of radio receivers in India was about 7,50,000, which meant that for every 1,000 people two radio sets were in use.

Assuming that comparatively cheap sets and electric power will be available, the Planning Commission estimated that the total number of radio licences would rise to about 1.8 million by 1955-6. The First Five-Year Plan envisaged an extension of the number of transmitters. About 170 million people, or nearly 50 per cent of the population, are to be served by medium-wave stations. Provision has also been made in the Plan for three more 100 kW. short-wave transmitters.

Expansion

Towards the beginning of 1953, the Planning Commission formulated the following programme of development:

	1950-1	1955-6
Number of factories ...	11	15
Annual rated capacity (numbers) ...	77,200	3,80,000
Actual production „ ...	49,053	3,50,000

In other words, the industry was to make an advance of 400 per cent in capacity and a sevenfold increase in production during the Plan period.

This expansion will, it is estimated, cost the industry in all about Rs 25 lakhs.

Progress during the years 1951-4 is summarized below.

Number of factories	...	1950-1	11
„ „	...	1953-4	15
Annual rated capacity ('000)	...	1950-1	77
„ „ „ „	...	1953-4	153
Actual production ('000)	...	1950-1	49
„ „ „	...	1951-2	88
„ „ „	...	1952-3	69
„ „ „	...	1953-4	58

The 11 and 15 units referred to above—some of these have developed in technical collaboration with foreign firms—represent only the organized sector. In addition, there are a large number of assemblers, operating on a small-scale and cottage basis. The Planning Commission has recommended the introduction of a licensing procedure and has suggested that licences should be issued only to those who have the necessary plant and equipment, especially testing facilities, and technical personnel to produce sets according to standards.

The quality of the Indian product is reported to be as good as the imported. The National Physical Laboratory provides facilities for testing radio receivers and components and advises on methods of improving quality.

It will be noticed that although capacity has very nearly doubled, there has been no great increase in production. Another point well worth attention is that the targets for both capacity (3,80,000) and production (3,50,000) are still very far ahead.

In the public sector, India will have, it is hoped, by 1956 a large-scale unit for 'the manufacture of a wide range of wireless and radar equipment, capable of meeting a majority of the requirements of the Armed Forces as well as those of Ministries and Departments of the Central and State Governments.' Production of radio and radar equipment of all types, including transmitters, receivers (excluding those intended for broadcast and television reception), trans-receivers, amplifiers and ancillary equipment is contemplated. It is proposed to manufacture radio components, and, in particular, electronic valves of all types required, by using available capacity to the fullest advantage. A site for the factory has been selected in the Jalahalli area at Bangalore.

General Prospects

The light electrical engineering industry has numerous offspring, some of which are seen, and others may soon be seen, in many shapes and forms. For instance, there are the lamps; articles which lend themselves readily to integration in other industrial processes; and a host of costly refinements. But as yet only a few (e.g. motors, transformers, lamps, fans, radios and batteries) have branched off from the family stem and 'set up house' on their own.

These industries have an almost identical history. Production before the war was negligible. During the war, not only were prices of imports higher but goods were often not obtainable even at those prices. Superimposed on this was the increased Army demand. In such conditions of peculiar urgency, State planning of production and control of distribution were inevitable. There was a steadily rising output; and happily this trend has continued since 1946. The tables given above showing production in successive years—the varying rates of progress are also a useful study—are indicative of the vast change that these industries have undergone in the last decade.

In most of these industries there is acute dependence on imports for raw materials—particularly ferrous and non-ferrous metals—and components; and supplies, besides being inadequate, have sometimes been irregular. Although there is a temporary easing in some directions, the

outlook remains uncertain. Manufacture in India is being attempted, but the rate of progress has not been spectacular. Production of pig-iron is being stepped up ; expansion of the aluminium industry is well under way ; a survey of mineral resources has begun ; development of lead and zinc mines is under investigation ; and all possible facilities are being offered for importing essential metals and other raw materials. The situation has undoubtedly improved latterly. Yet, it seems that for some years the gap between demand and home production of metals cannot be fully bridged. Early determination of priorities between different uses seems essential ; and the use of metals more easily available and avoidance of waste hardly less so. In this, a good beginning has been made ; and prominent among current efforts is the one to produce within the country as many of the components as possible.

There is little doubt that the manpower needs of these industries over the next few years will increase substantially. The quantum of production will depend largely on the industries' ability to undertake important technical work ; and it is in these grades that the scarcity of workers has become acute.

While in some industries, notwithstanding the heavy imports of machinery in the post-war period, the wartime arrears of replacement are still far from being covered, in others there has been considerable expansion of manufacturing facilities.

The capital costs of each industry are difficult to compute. Companies, with rare exceptions, have not confined themselves to one product, and reliable representative figures are as yet hard to come by. There is little doubt, however, that most of these industries have carried large development costs which have in some cases been shared by the manufacturer and the consumer.

A limited number of highly capitalized firms seem likely to continue to be the main source of output, for the newer type of apparatus requires large amounts of capital and/or highly specialized capacity. They will be supported by a conglomeration of small units, each specializing in a limited range of components.

Some of the more important companies have expanded during the last few years in co-operation and collaboration with foreign firms. Forms of participation and aid, technical and financial, have varied.

That several of these industries lack organization is a charge often heard. To judge fairly, one must have some idea of how, and in response to what circumstances, the present organization came into being. It was born of the war. Viewed in this perspective, its weaknesses are more easily understandable. This is no defence of the existing structure. Nor is it contended that present conditions should continue. Rightly, the Planning Commission is opposed to 'undue

multiplication of small units' wherever it has found that the existing number have adequate productive capacity to meet current demands.

For the chronic or, at any rate, recurrently acute surplus of productive capacity, two remedies seem possible : restriction of the number of units and stimulation of demand. Though the extent to which a company can alter the range of production in adjustment to temporary or long-term changes in the nature of demand is somewhat limited, the industry must improve existing and develop new techniques and products and adapt them to suit ever more exacting requirements.

The war created a seller's market. There was no strict adherence to requisite standards of quality. Those conditions no longer prevail. Quality is now a dominating requirement. Companies can now survive only on the basis of their efficiency.

Standards have been published or finalized for three-quarters of the total production of electrical industries, and this work will expand with increasing diversification of output.

The industry has complained of lack of proper testing facilities.

In some of these industries, an increase in imports has proceeded *pari passu* with increase in production. This, in the main, may be attributed to the rapidly increasing needs of other industries for electrical goods.

Almost all the industries which received tariff protection appear to have justified it. And in those cases in which imports continue, the reasons for such continuance are no reflection on the industries concerned.

The general progressive liberalization of trade, although it has eased the task in one direction, has added to difficulties in another ; for the freeing of imports has meant that to maintain his export market, the manufacturer will need to make his goods severely competitive.

Despite the extensive requirements of the country, a small percentage of the output of some of these industries is being exported ; and there is in being, and in prospect, expansion. But competition is bound to become keener. German and Japanese industries will soon get back into their stride ; and if the dollar situation becomes easier, overseas countries may take advantage of American deliveries. Manufacturers have no reason to be in the least complacent. Indian producers are putting through plans of expansion ; an indication, at any rate, of confidence in their ability to command a share of the export market. Scope for larger exports exists ; current capacity, which is in excess of demand, permits, and markets abroad have been increasingly receptive.

The conflict between production and demand has abated somewhat. The Planning Commission considers it essential that the demands which schemes for agricultural development and expansion of irrigation and

power will make on industrial products should be satisfied. In this task, light electrical engineering industries have a heavy responsibility. And it must be remembered that the national defence programme has not been revealed sufficiently for precise assessment of its effect on demand. Further, the gradual rise in the standard of living will create an aggregate of wants that must be satisfied. Increase in demand seems inevitable.

To meet it, there are plans of expansion worked out jointly by the Planning Commission and the industries concerned. It has been agreed that 'output should be raised to defined targets primarily through the fuller utilization of existing capacity by removing raw material shortages and by improving the efficiency of the existing units through modernization of plant and machinery, reorganization of un-economic units, standardization of production and scientific management.' Yet the plans are no rigid framework. In several of these industries, it is learnt, the particular arrangements necessary are being left to the individual firms so long as they conform to the Commission's basic requirements. Reports indicate that manufacturers are busy making their dispositions; that where action is within their power, measures are being taken to ensure as far as possible increase in production; that in this process the Industrial Finance Corporation has been of some assistance since its inception in July 1948—advances made so far to electrical engineering industries amount to about Rs 1.29 crores; and that the plans are generally working satisfactorily. In these there is hope for the future.

The development programmes represent primarily efforts to provide safeguards against two weaknesses, one material and the other psychological, to which the industry is prone: redundancy of productive capacity and fear of a lack of demand. It is costly to keep machinery idle. No one wishes to witness the needless jettisoning of industrial potential which, through some future favourable turn in the conditions of oversea or domestic trade, might make a useful contribution to employment at home and possibly to the country's total export trade. Not all the structural changes necessitated by the newer developments have yet taken place, but a distinct pattern is beginning to develop.

Proposals for the manufacture of new items are in various stages of maturity. For instance, although a variety of voltmeters, wattmeters, galvanometers, potentiometers, watt-hour metres, etc. are being manufactured, much has still to be done in the field of electrical measuring instruments; and hardly less in the other two segments, i.e. the manufacture of switchboards for generating stations, current transformers and precision electrical instruments (e.g. milli- and micro-voltmeters, mirror galvanometers, demand meters, synchroscopes, etc.) and the

manufacture of electric appliances such as refrigerators, vacuum cleaners, telegraphy, telephony and communication, electric hoisting and traction, electric signalling, mixers, washers, etc., etc. In present circumstances the process is understandably somewhat slow. The increasing generation and use of electricity seems likely to keep the industry fully occupied for many years. Indeed it seems possible that much more will be produced and sold. So that this possibility may remain, technical efficiency should be brought to the best international levels. The Government has set up a Development Council which will cover units engaged in the manufacture of telephones, telegraph apparatus and wireless communication apparatus, electric lamps and fans, batteries (dry cell and storage), radio receivers, house service meters and panel instruments.

The assurance that the public sector will only be complementary to, and not competitive with, the private sector is by itself not enough. There is need for a clear working agreement between the two on production programmes and division of markets. It would perhaps help to have a frank discussion soon on what criteria should apply.

The broad plan that emerges from the various programmes of development is fairly impressive. Properly implemented, the country should soon be self-sufficient.

With an annual total production valued at about Rs 25 crores, the industry is a substantial contributor to the country's economy, despite a continuing shortage of many vital raw materials and components. Overall improvement in output, however, is only one consideration. Most important, perhaps, are the new lines of production taken up and the new ranges of manufacture established to meet widely differing wants—important because such diversification, besides raising the standard of living, may well lead to higher levels of employment. The manufacturing methods necessitated by the new developments and the demands made by them on particular types of skill and equipment have in many cases resulted in technical adjustments and alterations in financial structure. With the increasing adoption of modern techniques, the ratio of skilled to non-skilled workers is likely to rise; and, with it, the conversion value of the finished product. It may well be in this direction that the future of the industry lies, for it has always depended on technical development.

There has been a noticeable movement towards increased capitalization, particularly in the larger firms. The home market is vast and expanding. Export markets have been established for some products; and Indian producers are constantly striving to better each year's figures. In sum, there has been a broadening of the industry's whole economic base. The structural changes now taking place are likely to continue. The industry is on the threshold of its development.

CHAPTER VII

THE COAL INDUSTRY

WITHIN the atom is a world of energy. Of its destructive effects there is proof. Constructive possibilities are being investigated, in India and elsewhere. These do not concern us here. For her growing needs it is assumed that India will continue to depend for fuel and power upon sources already being developed : coal, electricity and petroleum.

Together, their accomplishment is considerable. Their potentialities are vast and capable of meeting all demands made in the foreseeable future. Taken separately, each is making its contribution ; perhaps one more and another less ; and one directly and another indirectly. In the present state of our statistics, their individual contribution is not easily assessable. And for the future, they represent perhaps a conflict of expectations. What is clear, however, is their complex interdependence.

About ninety years ago Professor Jevons called coal 'the mainspring of modern industrial civilization'. That status the commodity has, by and large, retained. Relatively recently the U.S. Bureau of Mines described it as 'one of the most important of all basic materials, not only in industry, but in all phases of modern life.' In India, it is in addition a precious item in the national inventory, an important article of trade vital to the country's prosperity.

The principal coal deposits of India occur in strata known to geologists as the Gondwana series and the Tertiary series. The coal found, broadly speaking, is of three types : lignite, bituminous and anthracite. The chief coalfields are in the Damodar Valley in Bengal and Bihar. Coalfields of varying size also occur in Madhya Pradesh, Orissa and Hyderabad as well as in Bikaner, Assam, Kashmir and Madras. The good-quality coking coals are confined to the Jharia, Raniganj, Giridih and Bokaro coalfields in Bengal and Bihar.

In 1932, Sir Cyril Fox, a former Director of the Geological Survey of India, estimated the total reserves of coal of all qualities within a depth of 1,000 ft. at about 60,000 million tons. This estimate included seams of all thicknesses.

The Mining Committee of 1937 estimated reserves of coking coal at about 1,425 million tons. Notwithstanding such a heartening estimate the Indian Coalfields Committee (1946) took a conservative view of the extent and possible duration of the nation's coal wealth. It

suggested that it would be wiser to proceed on the assumption that the reserves of good coking coal might not exceed 700 to 750 million tons. In 1950 the Metallurgical Coal Committee after detailed field surveys reported that coking and semi-coking coals were available only in the Jharia, Raniganj, Bokaro and Karanpura fields in West Bengal and Bihar and a few other fields in Madhya Pradesh and that the total reserves available within a depth of 2,000 ft. were about 2,000 million tons.

According to the latest reports of the Geological Survey of India, reserves in seams which have a thickness of 4 ft. and over and a maximum ash percentage of 25 would be only about 20,000 million tons 'If we further restrict the estimates to coals that have 10 per cent ash (on moisture-free basis) and are 4 ft. and over in thickness within a depth of 20,000 ft.,' the G.S.I. adds, 'the total reserves would be reduced to about 5,000 million tons of which two two-thirds would be within 1,000 ft. depth.'

Reserves of good quality coking coals are confined largely to the eastern coalfields of the Damodar Valley.

The extensive coal deposits of Madhya Pradesh and Vindhya Pradesh are particularly suitable for steam-raising and the manufacture of synthetic oil by the Fischer Tropsch process.

Reserves of Tertiary coals in Assam, Rajasthan and South India are assessed at between 2,500 and 3,000 million tons.

Reports of recent geological investigations suggest that the coal resources of the country are actually much larger than estimates so far have shown. During 1952, 4- to 25-foot-thick seams of semi-coking and anthracite coal were discovered in the Rangit valley in Western Sikkim; reserves are assessed at 240 million tons. Many new coal seams and coal outcrops have been recorded in the North Karanpura coalfields, Bihar.

A survey of the coalfields in Singareni, Kothagudem and Tandur areas in Hyderabad State suggests the possibility of deposits in that area. During 1953-4, the Geological Survey of India discovered new seams in Sidhi District, Vindhya Pradesh; in Chin Bati Kala, Sikkim; in Raigarh District, Madhya Pradesh; in Adilabad District, Hyderabad (Deccan); and in the Khasi and Jaintia Hills. Occurrence in the Laldhang area in Garwhal district, Uttar Pradesh has been reported and a survey is contemplated.

Estimates of reserves have confined themselves to depths of 2,000 feet. Figures are not as yet available of the enormous reserves at greater depth. These cannot be ignored as mining at depths greater than 2,000 feet is now a distinct possibility.

South India should become more or less self-sufficient with the

development of the lignite deposits discovered in South Arcot. The tonnage in proved areas is estimated at 2,000 million tons and the quality is said to be very good—so good indeed that German experts have recommended, after tests, that it should be used for metallurgical purposes. The existence of large iron ore deposits only about 140 miles away, which could not hitherto be developed for lack of the right type of coal, vests these discoveries with adventitious importance. The Government of India has not been slow to perceive the potentialities. Assistance to the State Government in the form of the supply of finance and equipment to work the deposits was quickly arranged.

The occurrence of lignite in Umdasar (Cutch) has also recently been reported. The deposits are estimated at 10 million tons.

In all, therefore, it seems that while reserves of good-quality coal in the known Indian coalfields are not considerable, reserves of secondary and third-rate coal are large. And—this is important—much of the secondary and third-rate coal lends itself to 'beneficiation'; in other words, to improvement so that it can be used as good-quality coal.

In unofficial circles, reserves, of which only inferential geological knowledge was available, were sometimes added to the hitherto recognized coalfields and it was noteworthy that, notwithstanding the continued exploitation of the country's coal deposits, each successive estimate of the available reserves remaining was a considerable advance on its predecessor.

Having regard to the very speculative data, it is difficult to prophesy the probable duration of the country's coal reserves. While recent estimates of reserves of non-coking coal reveal no grounds for anxiety, total proved reserves are unknown. Moreover certain coalfields are showing signs of exhaustion. As far as can be seen, the bulk of future production must continue to come from areas already exploited. And greater mining difficulties in these areas are foreshadowed.

The need is clear for a more vigorous prosecution of exploratory work for new coalfields, not only with the object of increasing proved reserves of coal but also because of the influence which such coalfields would exert on regional industrial development. The concentration of the bulk of coal production in West Bengal and Bihar has made provision of transport, which has never been easy, all the more difficult. Regional development would without doubt result in immense relief to transport. And there would be the additional advantage of a lower price for coal on account of the lower freight charges. Proposals for developing coalfields outside the Bengal-Bihar area are under study by the Government and the industry.

Location and Structure

The present location of the mines is the result of the process by which the industry has gradually evolved from small beginnings to the dimensions of to-day. There was no planning—no directing authority.

Coal-mining as a commercial enterprise may be said to have begun in 1774 in the Raniganj field when small deposits are reported to have been exploited. Since then it has had a chequered career. The years 1914-18 were marked by increasing output to meet increasing demand from home consumers and importers abroad. During 1920-6 there was a fall in output, but prices continued to rise. Production again increased between 1927-30 but the industry did not escape the effects of the general trade depression of the early 'thirties. A large number of collieries closed down and some, in order to survive, resorted to uneconomic exploitation of coal. Overproduction led to a fall in prices. The years 1937-42 witnessed a revival. Demand increased and prices rose. But the prosperity was shortlived. During 1942-5 there was an acute coal shortage due to a fall in production, inadequacy of plant, shortage and drift of labour and transport difficulties. Since 1946 there has been a steady increase in production.

In Bengal and Bihar zamindars had the power to grant mining leases. In other parts of India, generally speaking, the Governments of the States reserved mineral rights to themselves.

Licenses were issued, often without reference to the technical competence of the applicant to operate the mines, and in consequence some of them fell into the hands of people whose interests in the industry were only financial.

There was no uniformity in royalty rates, resulting often in unfair competition between collieries. The situation called for statutory regulation. In 1948, the Indian Parliament passed the Mines and Minerals (Regulation and Development) Act. The Mining Concessions Rules, 1949, issued under the Act, came into force on 25 October 1949.

There are three types of collieries : large privately-owned collieries, small privately-owned collieries and large State-owned collieries. The large privately-owned collieries belong either to certain joint-stock companies or to certain large consumers of coal such as iron and steel, shipping and cement companies ; collieries owned by joint-stock companies are mostly administered by managing agents. Alongside this is the ownership of and management by families, general traders and financiers of a number of small collieries. The third type comprises those owned by the railways, now nationalized.

In 1942, the total number of collieries in India was 724, of which

collieries producing up to 10,000 tons per month numbered 337. In 1947, out of 902 collieries, about 478 were producing up to 10,000 tons per month.

The tendency has been to open small collieries in boom periods and close them, although only partly worked, in lean years. To minimise risks of fire, a barrier of 100 feet has to be kept between two adjoining collieries—a statutory requirement. With the large number of small collieries, the loss in output can well be imagined. And collieries with a capacity of less than a wagon a day have created serious transport problems. There has been wastage in shunting and ancillary services. Further, many of the small units have not the financial resources to obtain new equipment nor indeed to meet satisfactorily statutory obligations to labour.

Although during the last few years there has been a continued increase in the number of large collieries, the number of small collieries is still considerable. These small collieries reveal all the inherent characteristics of diffused ownership and individualistic enterprise. Many of them are too small to be good units of production. The table below is an attempt at a classification of mines according to their size, as determined by their monthly output.

NUMBER OF MINES PRODUCING

	Up to 100 tons	101 to 300 tons	301 to 600 tons	601 to 1,000 tons	1,001 to 2,500 tons	2,501 to 5,000 tons	5,001 to 10,000 tons	10,001 to 20,000 tons	Above 20,000 tons	TOTAL
Assam	3	..	2	2	6	..	3	1	..	17
Raniganj	43	28	32	10	73	43	37	24	9	299
Jharia	43	40	63	26	94	49	30	24	12	381
Bokaro	1	1	..	1	3	2	4	1	2	15
Giridih	..	..	..	..	..	..	..	2	..	2
Karanpura	2	..	4	..	4	4	1	5	..	20
Ramgarh	3	..	3	2	2	1	..	..	1	12
Jainty	12	3	..	..	..	..	..	..	..	15
Rajmahal	2	..	1	..	..	..	..	..	..	3
Daltonganj	1	..	..	..	..	..	1	..	..	2
Hutar	..	..	..	..	..	..	1	..	..	1
Madhya Pradesh	3	1	5	3	3	6	12	12	2	47
Orissa	..	..	..	..	1	1	2	2	..	6
Hyderabad	..	..	..	..	..	..	1	..	3	4
Rajasthan (Bikaner)	..	..	..	..	1	..	..	..	..	1
Vindhya Pradesh (Rewa)	113	73	110	44	3	1	1	2	2	9
INDIAN UNION	113	73	110	44	190	107	93	73	31	834

The integration of small collieries is a possible remedy; but, in contrast to the U.K. and U.S.A., no trend towards integration is discernible in India. State action seems the only solution. Further measures to prevent the uneconomic fragmentation of coal mines and to regulate

the leasing and subleasing of holdings are under consideration by the Government of India; and, as a preliminary, a survey of existing conditions in Bengal and Bihar, where the evils of fragmentation are at their worst, is under contemplation.

Obviously it is a formidable task which would raise difficult financial problems. The small units are of different standards of efficiency, at different stages of development and of differing degrees of commercial success. And mainly on these premises is based the view that the integration of small collieries should be left to come of itself.

Production from the eleven railway collieries represents 12 to 13 per cent of the country's entire output. From evidence available it appears that State ownership and operation of collieries was not for many years financially a success. The committee set up by the Government of India in 1949 to inquire into the financial results of the working of Government railway collieries reported that, although, as compared with market collieries, State-owned collieries were free from payment of income-tax and some of them were highly mechanized—advantages which should have been reflected in lower costs—some railway collieries were being run at a loss from year to year. Happily, however, latterly the situation has changed for the better. The financial review of the working of the railway collieries in 1951-2 showed that, unlike in previous years, there was an appreciable profit, amounting to Rs 10 lakhs.

A point on which the industry has been for some time much exercised is the absence of a clear declaration by the Government on nationalization. Hardly less uneasy has it been over the amendments to the Constitution relating to rights to property. As to the first, an announcement was made on 5 April 1955. Mr. Reddy, Production Minister, declared in Parliament: 'It is not the intention of the Government of India to nationalize here and now all existing private collieries.' The Government preferred to spend on new units, he said, rather than on taking over old ones. As for the second, the assurance that compensation will be paid is welcome.

Production

Since the earliest days of coal-mining in India there has been a steady increase in production. Average annual output rose from 9,87,000 tons in the years 1878-80 to 19 million tons in 1921-5.

The *Statistical Abstract of India*, 1949, gave the following figures :

1946	...	2,88,85,118 tons	100 per cent
1947	...	3,00,00,000 "	103.9 per cent
1948	...	2,98,22,257 "	103.2 per cent
1949	...	3,14,56,807 "	108.9 per cent

Since 1949 the coal industry has been establishing a new record every year. The production in 1951 was 3,43,07,563 tons as compared to 32 million tons in 1950. In 1952 the raisings of coal amounted to 36 million tons, a figure never before reached.

Production in 1954 amounted to 3,67,73,605 tons as against 3,58,46,898 in 1953 valued at Rs 52.7 crores. It exceeded the record production in 1952, when 3,62,22,531 tons were mined. In terms of percentages, it was 2.3 per cent higher than in the preceding year and 1.4 per cent higher than in 1952. Taken over a longer period, with 1946 as the base 100, the production index reads : 1950, 110.8 ; 1951, 118.8 ; 1952, 125.4 ; 1953, 124.1 and 1954, 127.4.

The coalfields in Bengal and Bihar produce annually about 82 per cent of the total output.

To meet the growing demand for coal in South India steps are being taken to increase production in the Singareni collieries in Hyderabad. Extraction is being mechanized and coal-cutting machines and electric drills are being introduced. Production in those collieries in 1951 was 10 per cent higher than in previous years and this progress is being maintained. A record production of 1,22,000 tons was achieved in May 1952.

The Coalfields Committee were of the opinion that the production and dispatch could be raised by $1\frac{1}{2}$ million tons annually so that by 1956 about 41 million tons would be available for consumption.

The Planning Commission estimated that, compared with a present output of about 36.77 million tons annually, the industry must budget to meet a demand of some 38 million tons in 1955-6. Plans notwithstanding, future production will depend principally on the nature of demand, progress in mechanization and the tone of labour relations.

Viewed in isolation, the present rate of production is perhaps gratifying. But viewed against the background of the country's size and population and of production in other countries, it is no matter for self-congratulation. The United Kingdom, with a small area and population, produces annually about 190 million tons.

Mechanization

The easier mines are being gradually exhausted, and the average depth of operations is increasing. Although now more difficult, mining must continue to be efficient, for coal is irreplaceable as an asset ; and as a basic commodity, its price influences the prices of several other products and ultimately the general cost of living.

Mechanization will result in reduction of costs and greater productivity as a result of increase in output per man-shift. But it is

governed by many factors : capital outlay ; offtake of coal ; supply of electricity ; availability of machinery ; import licences ; unamenability of labour to mechanized operations ; and possibly the need for complete reorganization and regroupment.

While there is scope in India for mechanization in the development of new mines, the possibilities of introducing such mechanization in the existing mines are rather limited because the conditions in mines in which pillars have already been formed are not usually suitable for machine-cutting.

Imports during recent years of coal-mining machinery are given below :

1951-2	...	Rs 39,10,965
1952-3	...	Rs 37,58,190
1953-4	...	Rs 37,60,156
April to		
December 1954	...	Rs 24,19,482

In December 1954, there were 457 coal-cutting machines in the collieries as against 306 in 1947. Coal cut by machines in 1954 formed 21.7 per cent of the total output in that year.

Attempts are being made to improve the quality and regulate the size of coal dispatched from collieries. Most of the large collieries have, and others are now installing, mechanical screens on which coal is passed before it is loaded into wagons for dispatch.

In so far as the existing mines are concerned, the Coal Board has under consideration the extent to which mechanization can be introduced without giving rise to unemployment.

The Government has decided that 'so far as new mines are concerned a condition should be imposed that all new development should be planned and executed as far as is practicable with the maximum possible use of machines for coal-cutting and coal-conveying.'

Labour

The question of manpower is vitally connected with productivity and technological development.

There are three distinct methods of recruitment in the market collieries, although two of them are very closely connected.

The first method, which is generally used by the larger collieries, is to recruit through commission contractors. The other method, employed by the smaller concerns, is to recruit their labourers through miners' sirdars, who are paid a very small commission which varies from colliery to colliery.

The third source is through the Coalfields Recruiting Organization. The method here is for collieries to place their indents with the Organization, and it supplies the labour to them direct in their own camps.

In the very small firms there is also local recruitment from nearby villages, which is usually done by the miners themselves bringing in their friends and relatives direct. Again, sometimes ex-C.R.O. workers are recruited on the spot when they present themselves at certain collieries.

No recruitment of miners is done through the Government Employment Exchanges.

The contract system for labour has been condemned by the Royal Commission on Labour, the Bihar Labour Inquiry Committee, the Indian Coalfields Committee, 1946 and the Conciliation Board, 1947. It has been abolished in the majority of the coalfields, both State and private. Pending the complete abolition of the system the question of securing for contract labour all the privileges now enjoyed by non-contract labour is being vigorously pursued.

Although less now than formerly—perhaps as a result of increased wages and welfare measures—the supply tends to vary with the seasons. Some workers return to the land for the harvest.

Workers numbered 3,21,537 in 1947 ; 3,08,263 in 1948 and 3,18,354 in 1949.

In January 1955, the average daily number employed was 3,50,077.

The industry provides employment for a large number of women who all work on the surface. Their main occupation is the loading of coal into railway wagons.

The total labour employed is far more than is employed in coalfields in other producing countries. Although, with increased mechanization, the number could be reduced, current trends suggest that the present volume of employment is not in jeopardy.

Improvement in the working and living conditions of labour in Indian coal mines is relatively recent. The Royal Commission on Labour in India (1931) reported that 'improvement in the standards and efficiency of workers . . . must be secured by better health, shorter and more regular hours and more mechanical assistance'. The Indian Coalfields Committee (1946) reported that 'there was urgent need for providing the industry with a settled mining force : and this could only be secured by improving working and living conditions and providing a better wage and adequate amenities.'

Progress in recent years, though not uniform, has been rapid and well marked.

As a result of the recommendations of the Conciliation Board and the Fact-finding Committees, miners to-day have their wages and

earnings so fixed that they are able to earn about four times as much as they could during the pre-war years. Free housing and free fuel are provided. Wages generally are paid every week. The Payment of Wages Act, 1936, ensures regular payment of all dues to workers, who receive basic wages varying with occupation, a dearness allowance and an annual bonus equal to four months' basic wages split into two parts : attendance bonus and production bonus.

Wages vary with areas. Through agreements between States, it should be possible to eliminate regional competition. Besides weekly wages, essential foodstuffs such as rice, wheat and dal are sold to the workers at concessional rates. The average weekly cost of concessions per worker is assessed at Re 1-2-1 ; and the total weekly cost to the industries at Rs 3,94,749. The average weekly earnings of colliery workers increased from Rs 11-13-0 in 1953 to Rs 12-2-3 in 1954. The industry's demand for relating bonus and wages to output has not yet been met. An Industrial Tribunal was set up in February 1954 to adjudicate upon wage structure.

Besides leave and monetary concession, the construction of pithead baths and creches and provision of standard medical facilities are now statutory obligations for all collieries. They are required to provide also certain recreational facilities.

In some of the private collieries evening mining classes for supervisory staff are arranged by local Governments. Arrangements for imparting technical education are also in some cases made voluntarily by some of the private collieries. Of late, batches of students have been sent to the United Kingdom for higher technical training in mining operations.

The hours of work in mines as regulated by the Indian Mines Act are 9 per day. When comparing output per man-shift worked, a point generally not borne in mind is that coal mines in India are not as highly mechanized as in some Western countries. Most of the operations are manual. It is comforting to learn that in 1954, with a smaller input of labour, a larger output of coal was achieved ; the average daily attendance was less than 3,33,000—about 1.5 per cent less than in 1953. In terms of output per man-shift, 1954 averaged 1.09 tons per miner/loader and 0.37 ton overall, as against 1.05 tons and 0.35 tons respectively in the previous year. A Coal Mines Labour Welfare Fund was constituted in 1944 under the Coal Mines Labour Welfare Fund Ordinance, which provided for the levy of a cess on coal and coke dispatched from collieries. The present annual yield from this cess is about 90 lakhs.

A welfare unit has been formed to prepare and carry out schemes financed from the fund for the provision of suitable housing accom-

modation, hospital arrangements and improvement of public health.

According to a notification by the Central Ministry of Labour, the coal industry, so far as it is concerned with the production and supply of coal and coke in the areas in which the Industrial Disputes Act extends, was declared to be a public utility service for a further period of six months from 14 July 1952.

A Standing Industrial Tribunal for the coal areas has been constituted by the Government of India to deal with disputes which are within the jurisdiction of the Central Government, and when parties in the dispute apply either jointly or separately to the Tribunal.

Trade unionism of the right type—the enlightened variety—has yet to develop. Labour is riven by factions. Several groups, based more on personalities than on policies, compete for leadership.

The number of man-days lost as a result of industrial disputes was 1,87,000 in 1948 excluding December; 2,71,000 in 1952 and 2,52,000 in 1953.

A compulsory provident fund scheme, which will provide for coal miners in old age, has been brought into force by the Government of India and is reported to be working satisfactorily. And contribution to the provident fund is compulsory—statutory provision has been made—for every worker. There is a Central Office under the control of a Commissioner for Provident Fund; there are sub-offices in different coalfields and an inspectorate.

The average annual collection of the Colliery Labour Provident Fund comes to about Rs 58 lakhs. The total assets of the Fund as on 15 March 1952, were Rs 2,08,71,185. About 3,98,000 persons are contributing and the number of dead accounts comes to 77,312.

From the establishment of this Fund several advantages have accrued. As a form of compulsory saving and provision for old age and retirement it is invaluable to the worker. Hardly less valuable has it been as an anti-inflationary measure in mopping up purchasing power. And as a source of investment in Government securities the Fund has been most useful. Over Rs 2 crores have, it is learnt, already been invested in Government securities.

The chief source of accidents is falls of roof and sides, and it is hoped that, with the more extensive adoption of hydraulic stowage, accidents from this source will decrease.

Although it has become appreciably safer in the last few years, coal-mining is still a dangerous occupation. Abroad, new authorities concerned with safety have come into being; new codes of safety regulations have been framed, and emphasis has been placed on training. In India, a comprehensive code of rules and regulations, framed under the Indian Mines Act, governs safety practices in mines. These rules

and regulations are being re-examined and new ones are being finalized. State Governments have been asked to constitute special courts to try cases of disobedience and to impose deterrent punishment on the guilty.

A beginning has been made in the training and education of mine workers in general, and subordinate officials in particular, in the observance of safety regulations and prevention of accidents. During 1953-4, 56 persons from collieries completed a full course of initial training in rescue and recovery work at the Jharia and Sitarampur Rescue Stations. Compensation for injury during operations is paid from a welfare fund constituted for the purpose. The amount varies according to the nature of the disability.

Plans for the establishment of a Mining Research Station at Dhanbad have been approved. Problems relating to explosions, fire and ventilation in mines, mine working, designing and testing of mining equipment and the health of mine workers will be investigated at the Station.

The incidence of injury in India, as will be seen from the table below, has not been much higher than in the U.K., the U.S.A., or the Netherlands.

FATAL INJURY RATES (per 1,000 persons employed)

Year	India	U.K.	U.S.A.	Netherlands
1947	0.74	0.85	2.48	0.75
1948	0.82	0.76	2.67	0.45
1949	0.75	0.75	2.19	0.35
1950	0.72	0.83	2.15	0.75
1951	0.91	0.81		0.59
1952	1.01			
1953	0.97			

Transport

The available rail transport capacity has to be equitably distributed among all essential traffic. Coal constitutes the bulk—about 40 per cent of the annual tonnage—of the total loadings; and takes up a high proportion of the total number of wagons available. Adequate transport is hence essential to sustain and develop this industry; and this need has so far not been satisfactorily met, although dispatches in 1954 were higher than those in 1952, which again was a good year for coal movement.

For the purpose of allocation of coal, industries have been classed under different groups in order of importance or priority. Allocations are sanctioned about the middle of each month for the succeeding month, taking into account the estimated output of coal,

the demands of the consumers and the number of wagons required per day for moving the coal. For each industry, there is a sponsoring authority, either Central or provincial, and it is the responsibility of that authority to ensure that the demands of the various units within a particular group are collected and placed with the Coal Commissioner sufficiently in advance to enable him to formulate the allocation proposals for the month.

Prior to the war, Indian railways had a distinct slack season approximately during the months July to December, when the movement of general goods traffic fell off quite considerably and consequently a larger number of wagons was made available for the loading of coal. During the war, however, on account of heavy military movements the demand on railways continued to be in excess of their movement capacity throughout the year. These conditions existed till the middle of 1948 when once again the movement of general goods traffic decreased and the slack season occurred; the number of wagons for coal loading offered by the railways exceeded the over-all demand. Again, during the months July to December 1949 the over-all transport offered by the railways for coal was in excess of general requirements. It must be made clear, however, that even during the slack season, the position with regard to transport to certain parts of the country remained unsatisfactory on account of railway bottlenecks. Generally speaking, transport is difficult throughout the year for destinations on the metre gauge system, particularly the Northern Metre Gauge System, as also for all destinations, including broad gauge destinations, in Southern India.

The difficult position with regard to the metre gauge system is due to a shortage of metre gauge rolling stock. With regard to South India, the main routes are via Waltair and via Balharshah and here the difficulty appears to be one of lack of section capacity. Although good non-coking coal is being produced in the Singareni coalfields in Hyderabad State—indeed an increase in production of about 1 million tons a year is being planned—it is not being used to the maximum due to lack of proper transport facilities. In order to supplement the inadequate rail transport facilities coal has been moved by sea from the Calcutta docks to areas in Southern and Western India. To a smaller extent, coal has also been moved by the rail-cum-river route to Eastern India.

In 1948 there was a wide gap between raisings and actual dispatches. The Ministry of Transport attributed the difficulties to the following causes: 1. Partition had deprived India of the North-West Railway—a loss of about 5,000 wagons; replacement of wagons after the last war has been a slow and costly process; imports came to Bombay and had to be routed through the G.I.P. and B.B.C.I. Railways. 2. Opting

of Muslim staff for Pakistan. 3. Food imports had to be sent from ports to the interior which meant traffic in the reverse direction. 4. Haulage difficulties owing to a large number of existing locomotives being over-aged. 5. Junction limitations and route restrictions. 6. Limited capacity of certain sections to permit the running of extra trains; and 7. Allotment of wagons for military movements, e.g. Hyderabad operations.

From about the middle of 1948, however, there was a marked improvement in the over-all transport situation.

The *Monthly Abstract of Statistics* for November 1950, published by the Government of India, showed that the number of wagons loaded with coal and coke in 1947 and 1948 was about 94,000 in each year and that in 1949 over 1,15,000 were used for the carriage of the two commodities. The Standing Committee of the Central Board of Transport decided in February 1949 that about 2,700 wagons a day should be allotted for coal movements from the Bengal and Bihar coalfields. The figure represented only the minimum, and allotments were often in excess of that figure.

It is now possible to assess progress in terms of precise statistics. The statement below shows the discrepancy between the demand for and supply of rail transport and summarizes improvements in the transport situation (the figures are in lakh tons and are monthly averages) :

		1950	1951	1952	1953	1954
Raisings	...	26,66	28,59	30,19	29,87	25,88
Dispatches	...	24,01	24,26	26,25	30,64	26,62

As mentioned earlier, because of lack of rail transport colliery owners have had to suffer the locking up of their none-too-abundant financial resources in mounting stocks of coal, and consumers have had to make do with less coal than they need. Indeed, in some cases it has operated as a brake on output, for there is no point in increasing production if there is no transport to move the material. In others, it has meant that the money spent on mechanization is a waste.

Hardly less aggravating is the delay in the washing of low-grade coal to meet the increasing demand for coke from the expanding iron and steel industry. For instance, the Jamdoba washing plant could not work to full capacity. And often such wagons as were supplied were not of the right type; collieries fitted with mechanical screening plants were offered 'an inordinately high percentage of covered wagons'.

Among the suggestions for further improvement of the transport position, the more important have been :

1. Integration of the railways under one Railway Authority.¹

¹ This has already been effected.

2. Electrification of the coalfields.
3. Expansion of line capacity.
4. Improved transshipment arrangements from broad gauge to metre gauge.
5. Expansion of the yard at Waltair.
6. Better provision of assisted sidings.
7. Introduction of an insurance scheme to cover losses of coal in transit.
8. Provision of improved and enlarged types of open wagons.

Control over distribution has been necessitated, and possibly partly justified, by the following factors. Transport available, inclusive of all the three forms—rail, road and river—is not adequate; 'there is no possible way of getting an accurate estimate of what the railways will offer during any given month', and there is a shortage of production—at any rate of some of the qualities and grades—in relation to demand. Apart from being comparatively costly, road and river transport can at best carry only a small quantity. While, on the whole, output may be sufficient to meet demand, a shortage of some of the grades (e.g. superior) persists. The basis for the restrictions on supplies of high-grade coal is the possibility of utilization of the lower grades which are more freely available.

A scheme of movement quotas has been introduced to supplement the priority system and 'in a way to modify it so that the shortages of transport could be distributed to some extent over all the categories of consumers instead of letting them fall almost entirely on the lower priorities', and there is provision for special movements to meet the needs of the individual consumer whose stocks reach a critical stage.

By and large, distribution control has been 'a system of rationalized transport whose product appears to be not a rationalized but a rationed system of coal supply to users for whom there is plenty waiting at the pitheads.' However commendable theoretically, in practice the measures taken to reduce cross-movements and supply consumers from the nearest coalfields have not been altogether satisfactory. For one thing, they have in many cases upset the long-established business relations between collieries and their customers.

Were the total loss to the country due to shortage of transport for coal assessed, including loss in industrial production, in export trade, and as a result of the enormous demurrage incurred at ports, it would doubtless justify a generous outlay on the part of the Government on construction of additional wagons, with a corresponding increase in the

number of locomotives and improvements in track and junction facilities.

Coal contributes perhaps the largest amount to railway revenues. The demand that a greater part of that revenue should be set apart to provide the facilities essential for operation is intrinsically valid. Foreign aid might also be sought to improve conditions.

Current annual demand is assessed at 39 million tons. Measures taken so far to find the transport for this wider market seem at best palliatives. But there are circumstances in extenuation. It is not that there has been, latterly at any rate, no 'transfer of emphasis from limiting traffic to the facilities available to devising facilities for the traffic offering.' The construction of additional wagons is limited by capacity. Wagon building is mostly confined to the private sector. The railways gave the wagon builders an assurance some time ago of their willingness to purchase 12,000 wagons a year for five years; and were prepared to increase the order if there were evidence of capacity to produce more.

Recent statements in Parliament suggest that the Transport Ministry is planning to get about 22,000 wagons a year. But the maximum capacity of the builders, including new ones, is less than 13,000. And as against the provision in the railway budget of Rs 95.60 crores for works, machinery, rolling stock, etc., during 1954-5, the estimate for 1955-6 was Rs 1,26.68 crores. This figure includes Rs 76.54 crores for rolling stock alone. This is evidence of effort to cope with the country's coal traffic.

An enhancement of coal freight rates by 30 per cent was announced by the Minister for Railways while presenting the railway budget for the year 1952-3.

Colliery owners protested against this increase. They pointed out that in view of the wider issues involved the plea of the cost of carriage was untenable; that coal, being almost the basis of all industry, a rise in its price was sure to be reflected in the prices of all industrial products (e.g. electricity, gas); that viewed from that angle, increase in freight rates seemed hardly a step in consonance with the Government's declared policy of bringing down prices; that increased freight rates would not be without repercussions on the coal export trade; that it would impair their competitive capacity in foreign markets; and that it might before long reduce the country's earnings of foreign exchange. There are no signs yet of a reversion to the old rates.

The cost of production has steadily risen. Factors principally responsible are increases in wages and in the price of raw materials for labour; provision of further amenities to workers; falling productivity;

increases in the cesses levied and in the cost of colliery equipment and stores ; restriction of production ; and the locking up of a large part of liquid resources in mounting stocks of coal at pitheads.

Wages and allowances, always a preponderant element in the cost of production, are now even more so. Not only has the industry received no concessions on the selling prices of rations, but it has had to bear the entire cost of procurement. The legitimate demand for replacement of supply of foodgrains by cash compensation — legitimate because it would limit and define financial responsibility and possibly lead to an improvement in labour relations — has yet to be met. Not all the labour amenities stipulated by welfare legislation appear justified. Indeed, some of them seem in present circumstances wasteful, for labour is as yet unable to take advantage of them. Pithead baths and creches are instances in point. And bonus is linked to attendance rather than to output. To the evolution of a socialistic pattern of society the industry has no great objection. Indeed it has identified itself with the workers' interests ; it has only asked that the advancement of such interests should be compatible with the industry's ability to pay ; a factor not totally unconnected with labour's own contribution to the productive effort.

Collieries whose costs were rising sought to cover them by raising more coal, for heavy overheads and working costs could be borne without much discomfort as long as output was being progressively stepped up to cater for an expanding demand. That method of dealing with higher costs soon ceased to be economic. With the diminution of exports and the inadequacy of the railway system, production had to be curtailed ; and the burden of inflated costs immediately became apparent. Collieries have had to adjust their working expenses rapidly to the conditions of a contracting market.

Output has run ahead of the railways' ability to move coal from the fields to the markets. In consequence, a large proportion of the capital of colliery companies lies immobilized at pitheads. Mounting stocks have meant a severe financial strain ; and might result in a total loss, for coal heaps exposed to the atmosphere, apart from the danger of spontaneous combustion, deteriorate rapidly.

Although coal is a wasting asset, the allowances for depreciation, repairs to and renewal of capital equipment are no higher than those for other industries.

In aggravation there have been increases in the rates of cess levied. And the Road Cess and Education Cess levied on colliery profits are not allowed as charges for purposes of income tax — a procedure tantamount to additional taxation.

Obviously, charges of such dimensions cannot be borne without a

demand for a compensatory revision of price schedules. In a free market the price of coal would have rocketed, and the rise would have been reflected in increased costs almost throughout the industrial structure.

Selling Prices

Under the Colliery Control Order, 1945, prices of coal have been fixed. Yet, for the market, coal produced in one colliery often competes with coal from another. Retail selling prices of coal and coke are fixed by the State Governments within the local limits under delegated powers from the Central Government. In fixing the retail prices by the State Governments the following charges, in addition to the controlled pitmouth prices, are taken into consideration :

1. Railway freight.
2. Freight surcharge.
3. Excise and stowing duty.
4. Labour welfare cess.
5. Octroi.
6. Provincial sales tax, where leviable.
7. Middleman's commission, where middlemen are employed.
8. Wastage that may be considered allowable by the local authorities.
9. Handling charges of depot holders, to be fixed by the district authorities by taking into consideration local conditions.
10. Depot holders' profit, to be fixed by the district authorities in line with local conditions.

Coal prices were originally fixed on the assumption that the whole, or nearly the whole, output would be sold. That assumption is no longer valid ; and hardly less so the basis of production costs in 1947 on which the prices were determined and subsequently, in 1949, reduced. A part only of production reaches the market ; and while costs have advanced steadily, prices have remained static. Proceeds from sale have not been enough to meet the high production costs ; and in consequence profits have been cut to the bone. The general picture is one of gradual impoverishment. Colliery owners may be excused for feeling that, however, correct their financial arrangements may be, strong and persistent forces are making it progressively difficult for them to earn a reasonable profit, and that they are being compelled 'to run very fast to remain where they are.'

On the analogy of the assistance given to the steel and cement industries, there has been a demand for an upward revision of prices. The gulf between the plan for coal and its fulfilment can be bridged

only by large capital resources ; and these resources, may not, it is feared, be forthcoming unless prices are fixed at levels economic for average collieries. In the result, the country may have progressively less coal available for her plans and programmes of industrial development. So far there has been no satisfactory response from the Government. Perhaps Authority is of the view that the economy of the industry should be able to adapt itself to fluctuations in costs without serious internal repercussions. The fixing of prices is full of complications, for the level affects the entire industrial economy.

Special importance attaches to the regulation of coal prices, for coal is still a very important indigenous source of fuel and power. A point of importance is that these prices should not, and it is hoped that they will not, be rigid. Technical developments in the utilization of fuel will affect the relative value to consumers of various grades of fuel.

Imports

In an expanding economy some increase in the volume of imports must be expected. The statement below suggests the measure :

Imports	Coal and Coke	
	Quantity (Tons)	Value (Rs)
1951-2	63	5,212
1952-3	404	20,386
1953-4	1,000	2,66,070
April to December 1954	1,001	2,69,845

By and large, imports have been negligible. From 8,555 tons in 1946-7 they have fallen to about 1,000 tons.

Consumption

Consumption covers a wide range of industries.

Ten per cent of the output is consumed by the collieries themselves. The Ministry of Production gives the following average monthly figures (in thousand tons) for the distribution of coal (dispatches by rail) during recent years :

	1948	1949	1950	1951	1952	1953	1954
Indian Bunkers and Exports	146	127	140	213	221	148	146
Railways	796	841	825	865	940	956	941
Electricity Supply Cos.	160	174	187	195	214	232	223
Cement	56	63	77	100	110	121	121
Cotton Mills	156	150	139	134	144	146	147
Jute Mills	53	48	48	41	45	43	40
Engineering	19	23	30	28	29	29	22
Paper Mills	33	36	37	40	44	44	44
Chemical Industries	12	13	16	14	16	19	21
Brick Burning	57	102	143	112	96	134	152

Potential requirements of coal are vast. Although India is the second largest coal producer in the Commonwealth, her industrial development has not progressed, it is said, beyond one-twentieth of her capacity. Despite plans for the increased generation of electricity, and possibly, bigger supplies of oil, it appears that the demand for coal will grow. The greater industrialization that will, in all probability, accompany larger output of 'hydel' power will result in an increased demand for coal.

The steady increase in installed capacity in the electricity supply industry indicates increasing consumption of coal. To produce 1 million tons of synthetic petrol, it is estimated 7½ million tons of low-grade coal would be required. The iron and steel plant which the Government proposes to install will need large quantities of coal, most of which will have to be of the metallurgical coking quality.

The Planning Commission is in agreement with the estimate of the Indian Coalfields Committee of 1946 which put demand in 1955-6 at 39 million tons. Although output has been increasing, there is yet a shortage, particularly of certain grades of coal; and there is still a large unsatisfied demand for soft coke.

Factors affecting future demand, directly or indirectly, appear to be: a decrease in coal supplies to South India if and when the Arcot lignite project becomes a practicable proposition; the tendency to use oil instead of coal in railways (e.g. in Saurashtra), steel works, cement works and ships; the electrification of railways and the increased coal requirements of the expanding railways; the new thermal power stations planned; and the new industries springing up, apart from expansion of the existing ones.

Recent trends in inland consumption and other fuel and power industries, it is true, suggest a smaller volume of demand for coal. Indeed there have been fears of a glut. But it seems a temporary phase. In final analysis, it would appear that it is not likely in the near future that any alternative fuel will replace more than a fraction of the enormous and increasing coal consumption inherent in further industrialization.

Coal Conservation

The use of coal in India has, till recently, not merely been uneconomic but positively wasteful. There were no attempts at a regulation of production, nor indeed at a rationalization of consumption by a critical examination as to whether the different grades of coal used for various purposes were really necessary for those purposes, and no investigation as to how lower grades of coal might be utilized in place of good-quality coals.

Reserves of non-coking coal need cause no anxiety. But those of coking coal should ; for firstly they are small, and they will dwindle still further if proper measures of conservation are not taken in time.

The need for conservation has been stressed by successive coal committees. According to the Metallurgical Coal Conservation Committee, India's reserves of coking coal amount to about 2,000 million tons—an estimate accepted by the Planning Commission as a basis for calculation. This estimate is based on the assumption that stowing, washing and blending will be undertaken. Were these measures not taken, the Committee reported, the estimate might well be halved. If the steel production of the country was stepped up tenfold, the Committee added, coking coal reserves might not last, despite precautions taken, for more than 15 years.

The latest estimates of reserves of metallurgical coal of different grades in India are as follows :

Working Collieries	Million Tons
Selected A	404
Selected B	577
Grade I	513
Grade II	504
Total	1,998
Virgin Areas	
Selected A & B	330
Grade I	396
Grade II	49
Total	775

The above total quantity of 2,773 million tons of metallurgical coal is estimated to be equal to 2,100 million tons in terms of beneficiated coking coal.

Dr. Krishnan, Director, Geological Survey of India,¹ estimated that at the present rate of consumption and under present methods of working, coking coal reserves will last barely 80 years. This life could almost be doubled, Dr. Krishnan added, if stowing, beneficiation and blending of coals for the manufacture of coke were adopted forthwith.

These figures illustrate in concrete terms both the need for, and the

¹ He has since been succeeded by Dr. V. P. Sondhi.

nature of, the type of programme of conservation which the country must implement. Obviously it calls for a good deal of careful planning.

The Indian Coalfields Committee posed the problem ably in 1946. They said :

'The reserves of good coking coal in the country may not exceed 700 to 750 million tons and at the present rate of output they will be exhausted in about 65 years. In war time, even with the control over distribution, considerable quantities of good coking coal went to the railways, bunkers, exports and a number of consumers other than iron and steel works and coke ovens. . . . The emphasis placed on the coal export trade in the past has no longer any validity. Exports may normally be permitted only to Burma, Ceylon and the Straits Settlements, subject to certain limits ; export to other countries may be permitted only in special circumstances. . . . It is necessary to pursue vigorously a study of the blending and washing possibilities. But even with full resort to blending and washing it is unlikely that the resources available for the use of essential consumers of good coking coal will last more than 120 years at the present rate of exploitation. The use of good coking coal should therefore be restricted. It should be confined only to iron and steel works and coke ovens, and its use by the railways and other industries and for luxuries and export should be prohibited. The railways certainly require good non-coking coal for their mail and express services but can use Grade II coal for goods services. There is need for studying the possibility of designing future locomotive boilers to burn high-ash coals. To facilitate the task of restricting output, a study should be made quickly of the collieries producing good coking coal and coal which may prove suitable for washing. The regulation of the use of coking coal would best be secured by a system of licensing. The essential prerequisites to an orderly regulation of use are a chemical and physical analysis of coal seams and a study of the coal requirements of various classes of consumers.'

It is obvious from the above that the fuel problem in India will assume increasing importance in determining the future industrial expansion of the country ; and that the immediate necessity is to make the most efficient use possible of such coal as is available. And the coal that is available is definitely not of the highest quality. It is said to be inferior to British coal in that it has a higher ash content and lower calorific value. Government and the industry have not been unaware of the urgent need for a policy of coal conservation. A

multilateral attack has been launched on the problem. The Fuel Research Institute is actively engaged in determining the right kind of fuels for each class of industry. Its former Director, Dr. J. W. Whitaker, stated at the World Power Conference held in London in July 1950 that :

'India's good-quality coking coal would in future have to be used for producing steel and not, as at present, for burning railway locomotives. India's steel industry would in future probably consume three to four million tons of coking coal a year. This would meet the requirements of the two new State steel works, together with extension to the existing steel works at Jamshedpur. . . . For the time being the railways, which had been consuming 10 million tons a year, would largely, if not entirely, use non-coking coal. At a later date, with the development of hydro-electric and thermo-electric power, more of the tracks would be electrified, and definite fuel economy effected with increased all-round efficiency and cleanliness. Efforts by the Indian railways to increase their fuel efficiency might result in cutting their fuel consumption by half, a saving of Rs 7 or 8 crores a year . . . India was also considering building coal washeries. Distances were so great that coal had often to be hauled 1,000 miles. It was therefore essential to see that only clean coal was transported. If there was 30 per cent ash or dirt, it would mean that one wagon out of every three was carrying rubbish. The necessity for washing coal has arisen from the fact that the steel industry requires low-ash coking coal and that the bulk of the Indian supply had ash ranging from 16 to 25 per cent. A reduction to 15 per cent in the ash content by washing would effect considerable economy in transport.'

Electric power used by the railways in 1949 was of about 20.5 million kWh. With the completion of the hydro-electric projects undertaken by the Government of India, a more rapid electrification of railways, with a consequent considerable saving in coal, is expected. Electrification of 900 miles of railways in coal areas is under consideration. But the economics of railway electrification are to a large extent dependent on traffic density and physical conditions. High coal prices tend to favour electrification.

The use of low-grade coal by railways and certain industries, however, is fraught with difficulties. It means redesigning locomotives and factory equipment. The Indian Railway Enquiry Committee reported that, where attempts were made to use low-grade coals on the railways, the results were not satisfactory.

In contrast, however, is the opinion of Dr. H. J. Nicholls, Member, Railway Board, who not only admits the possibility of, but urges the need for, the use of low-grade coal and envisages considerable savings of coking coal as a result.

The arrival in India of YP locomotives from the U.S.A., the U.K. and other European countries should improve the situation. These locomotives have been designed to burn non-coking coal, and incorporate the standard features laid down by the Loco Standards Committee of the Railway Board. There is evidence of attempts by the Railway Board to re-examine hitherto accepted designs of both passenger and goods stock and their methods of operation, with a view to using lower grades of coal. The eventual dropping of steam locomotives entirely and the substitution of coal-dust gas turbine power units is also contemplated.

There is a growing realization that the use of coal for power is wasteful. Thermal generation of electricity from coal is economical, but hydro-electric development still more so from the point of view of coal consumption.

The possibility of hydro-electric energy supplementing—supplanting is obviously out of the question for some years—the thermal energy of coal is being actively explored, but the generation of electrical energy from water power has to reckon with the difficulties of terrain and topography; and in many places it is feared that the use of electric energy may prove uneconomic.

Although the improvident use of the country's dwindling resources of metallurgical coal has often been publicly deplored, only latterly has the need been recognized for husbanding supplies, two-thirds of which were being used improperly. Power has been assumed by the Government for the purpose. The Mines and Minerals Regulation Act (1948) empowers the Central Government to make rules for the conservation and development of minerals.

The Government of India issued on 8 January 1952 an Ordinance providing for the setting up of a Coal Board, under the chairmanship of the Coal Commissioner, for the conservation of coal and maintenance of safety in coal mines. The Ordinance, which applies to all coal mines including those belonging to Government, empowers the Government to levy, from a date to be notified, an excise duty of up to one rupee per ton on all coal and coke dispatched from the collieries. The rate of duty may be fixed from time to time and different rates of duty may be levied on different grades of coal or coke. The Government may also levy an additional excise duty of up to five rupees per ton on coal of selected Grades A or B, and up to two rupees per ton on coal of Grade I. The Ordinance further

empowers the Government of India to levy a customs duty, at rates equivalent to the excise duty, on all imported coal. The proceeds of the excise duty will be paid by the Government to the Coal Board and these will be credited to a fund called the Coal Mines Safety and Conservation Fund, which will be utilized to meet the Board's expenses.

Among the preliminary steps taken by the Board the more important are the restriction on the opening of new collieries producing metallurgical coal and the prevention as far as possible of the diversion of metallurgical coal for non-metallurgical purposes. It has been decided by the Government that there should be no further increase in the production of metallurgical coal and that, on the contrary, production should be gradually stepped down during the next five years.

The Board has under consideration schemes for fixing the output limit for individual collieries. These schemes will have to be so devised that collieries are not rendered uneconomic and that retrenchment of labour is as far as possible avoided. Also under consideration are the possibility of blending metallurgical with non-metallurgical coals ; the washing of low-grade coal to reduce its ash content ; and the extent to which mechanization can be introduced in the existing mines without giving rise to unemployment.

Among the principal measures under implementation are the regulation of : mining methods, the opening or reopening of coking coal mines, output, use, blending, stowing, washing and research. A new set of rules, framed under the 1948 Act, came into force on 1 April 1955. According to it, every owner of a mine shall employ a geologist or a mining engineer, for bringing prospecting and mining operations into line with approved practices. The Director, Indian Bureau of Mines, has been empowered to enforce adoption at the mines of scientific methods of working. A Manual of Instruction has been prepared to guide the industry. A Mineral Advisory Board has been set up to ensure the conservation, scientific exploitation and development of mineral resources as well as the promotion of the mineral export trade.

With a view to conserving metallurgical coal, the Government of India decided that no permission should be granted for the opening of new mines or the reopening of closed mines producing coking coal. This has now been taken a stage further. Except under special circumstances, permission is not granted for the opening of seams in a working colliery producing coking coal.

The production of coking coals in selected Grades A and B and I and II is pegged to certain specific quantities from year to year.

Consumers have no freedom in the choice of their coal requirements. Industrial units have been warned against changing to a process of

manufacture involving increased coal consumption without ascertaining from the Coal Commissioner whether the additional supply can be arranged.

Stowing for conservation in mines producing metallurgical coal is now a matter of urgency. If the coal is extracted without stowing, about 50 per cent is likely to be lost. Stowing is no new technique. Private collieries have developed it to a remarkable degree. Financial assistance — 75 per cent of the cost, subject to a maximum of Re 1.5 per ton — is being offered to collieries. Not all collieries are favourably situated for supplies of sand and soft stone.

In regard to coal washing, the Tata Iron & Steel Co. Ltd. are pioneers. Two coal washing plants have been set up, one at Jamdoba and the other in the West Bokaro collieries. The Report of the Council of Industrial and Scientific Research on coal washing shows that coal 'beneficiation' is a practical commercial proposition and that it can be achieved with more or less success according to the particular seam. The Czechoslovakian Technical Mission which was consulted on the subject expressed the opinion that for steam purposes Indian low-grade, high-ash coal could well be used; and that many of the high-ash coals in the Jharia fields could be separated into two or more groups, one of which would be suitable for the manufacture of coke. It was obvious that every effort must be made to 'upgrade' coal, and the advantages that the country might gain at present by the export of washed coal were not small, and deserved full and immediate consideration.

Experience with the two washeries set up in 1952 showed that coal washing was both practicable and economical. A committee was set up early in 1953 to investigate and report on the various problems — economic, financial and technical — connected with the establishment of coal washeries. It reported that, considering the heavy capital cost of moving inferior grades of coal and the opening of new mines for high-grade coals, there was an *a priori* case for making an attempt to lower the average ash content by at least 5 per cent even if this meant an increase of Re 1 to Rs 2 per ton for the higher grades of washed coal.

This object, the committee felt, could not be achieved by offering a subsidy or consistency bonus on washed coal or providing loans to private enterprise. The installing of multi-plant and multi-purpose central washeries of large tonnage near the existing railway marshalling yards or base loading stations operating under a Central Marketing Agency having a monopoly over the sale of all coal produced in India was recommended. Central washeries would be more economical, it was thought, than individual units at the mines; and to ensure against an unreasonable increase in price to consumers and to guarantee a stable

price structure to producers of coal, the committee suggested pooling the profits and losses of various central washeries and control over the zonal selling prices of coal.

The washing of coal is obviously a necessity. Loading the already inadequate transport system with incombustible matter cannot continue. The establishment of washeries is no easy process. Firstly, an unplanned growth has to be guarded against. Once established, to be economic, they have to work to full capacity. And the decisive test will be whether the enhanced efficiency of coal as a fuel will outweigh the increase in price inevitable in processing.

The indications are that financial assistance in the form of subsidies will be offered to private collieries to set up washing plants; and if the response is not encouraging the Coal Board will itself undertake the establishment of two or three large-scale central washeries. Coal will then have to be disposed of at prices fixed by the Board either at the Coal Board washery or at any other washery approved by the Board.

As the full implications of a Central Marketing Organization have yet to be studied, the setting up of such an agency may be postponed. Reports suggest that the Coal Board has no objection to the formation of groups where that can be done conveniently, perhaps because for smaller collieries the establishment of an economic washery may be feasible only by pooling capital resources. The installation of more washeries in the private sector does not seem likely until it is known what price can be had for the product.

A useful contribution to the country's fuel balance seems possible from experiments in coal blending now in progress. The Report of the Council of Industrial and Scientific Research on the blending of coals for coking shows the possibilities of using coals hitherto considered unserviceable for coke manufacture. The conclusion reached is that considerable quantities of feebly coking coal could be mixed with good-quality coal to yield sound metallurgical coke. These experiments may open up completely new possibilities for the utilization of coal.

The formation of the Coal Board and the present policy of coal conservation have been the subject of considerable criticism. On many fronts they have been vigorously assailed. Firstly, it is pointed out that ordinances are designed for dealing with national emergencies; and that in regard to coal no such national emergency had arisen. Secondly, that the Coal Board, in the formulation of its policy of conservation, had proceeded on certain basic assumptions—assumptions whose correctness was very much in dispute. The amount of reserves of coking coal is one instance. Consumption for the next few years is another. In planning so far ahead, it is pointed out, the planner faces a long list of unknowns which are apt to falsify the keenest

reckoning; and any falsification by events of assumptions made could throw the proposals badly out of gear.

Account has also not been taken, it is pointed out, of the possibility of further discoveries of suitable coal deposits; the possibility of designing a new type of coke oven—to produce metallurgical coke from feebly coking or non-coking coal as is done in Western countries; and of the probable addition to reserves by sand stowing, washing and blending.

Some sections of the industry are acutely apprehensive that restrictions on output, if too severe, may impair the economy of several working collieries—that it may even result in the closing down of some. Should collieries close down and machinery be moved out, it is contended, there is a danger of the metallurgical coal in the area being lost for ever through the flooding of the mines. Further, reopening operations would be extremely difficult. To bring a new coal mine into operation or completely reorganize a pit seldom takes less than a few years. Rarely are such projects undertaken, capital being required for more attractive ventures. In all probability, therefore, coal unmined will be a loss to the industry.

Indeed the loss is not limited to the industry. It includes the country. As output cannot be increased at will, it is pointed out, the limiting of production is likely to jeopardize the country's industrialization plans; and exports may all but disappear.

Attention is drawn to the resultant disorganization of transport; the disastrous effects on plant and equipment of forcing railways and industries to use unsuitable grades of coal; and the consequences, in view of conditions of work varying so greatly from colliery to colliery, of any general restriction on production. Plant was built under specification to consume certain consistent grade of fuel. To use lower grades, it is feared, would affect operations adversely. Replacement under present conditions, of existing by new equipment, suited to lower grades of fuel, is bound to be slow.

Attack has been particularly fierce on the propriety of forcing market collieries first to limit production. In the enforcement of conservation, it is contended that 'the principle should be that it is applied first to the captive collieries of those consumers (iron and steel products) for whose benefit conservation is being adopted; second, to Statg railway collieries, not only because they can be closed down without difficulty and reopened at short notice; and third and last should be the market collieries, and in their case care should be taken to ensure that they are subjected to conservation only according to capacity.'

By and large, the feeling is that the Coal Board is running much faster than it should; that conservation is not an idea that can be 'put into top gear' at once; and that the industry is asked to pay a very high

price for the acceptance of a principle whose practical results may well amount to very little.

A bolder, if less wise, section of opinion has suggested the imposition of restrictions on the output of steel instead of on coal.

The general reaction to the Government assistance given for stowing is that, although welcome, it is hardly adequate. Indeed, some sections have complained that the Coal Board's formula for calculating assistance bears little relation, in many cases, to the actual cost; that the burden is much too heavy; and that without increased aid, the industry may find it impossible to continue operations.

An aspect of administration over which the industry is not altogether happy is 'the concentration in the hands of one Government officer of the administrative functions of the Chairman of the Coal Board, the Coal Commissioner and the executive head of the State collieries.' That when the interests of the State and private collieries are at variance, as sometimes they are, an officer should be the judge of his own case, is thought anomalous.

The Government, while admitting that 'unknowns' may bedevil the best-laid plans, answers that they can be met by continuous adaptation. A point on which it is emphatic is that, although the utilization of a greater proportion, if not an entirety, of low-grade coals in some industries may involve serious disadvantages, consumers' choice of fuel should conform to national interests. The Planning Commission has supported the policy of strict enforcement of conservation measures.

Exports

All the important coalfields of West Bengal and Bihar are situated within a distance of 130 to 175 miles from the port. Dispatches against contracts have had to be limited due to paucity of steamers. And conditions in the port of Calcutta for loading coal leave much to be desired. There is, it is learnt, a considerable lack of technical personnel (pilots, harbour-masters etc.) and vessels have had to wait on occasions for over a fortnight to secure a coal loading berth.

India had built up prior to World War I a large export market through Calcutta, mainly for her Bengal and Bihar coal. Owing to rapidly increasing internal demand exports were prohibited for a time. Although they became permissible again after the war, not much headway could be made in foreign markets due to keen competition from South African coal.

Exports for the years 1921 to 1925 averaged 1,82,000 tons per year as compared with the average of 6,20,000 tons for the years 1916-20. This serious decline in exports attracted the attention of the Govern-

ment and resulted in the formation in February 1926 of the Indian Coal Grading Board to provide for the grading of coal and the granting of certificates for coal intended for export. The operations of the Board have to a large extent satisfied foreign consumers.

With the beginning of World War II coal exports soon dwindled as the gearing of India's industry to war tempo resulted in a demand that was difficult to satisfy.

After 1946, the Indian coal export trade made the most determined efforts to recapture lost markets and, aided by the fact that there had been an almost universal shortage of coal, it succeeded to a most satisfactory extent; exports were at a high level. Valuable new markets were found in Japan and Australia, and Indian coal was shipped to such unusual destinations as Britain and Finland.

In September 1949 the Government of India prohibited the sale or export of coal or coke or other derivatives of coal through private or non-governmental agencies. All future exports were to take place on Government account only. Fears of a falling internal demand led to appeals from the industry for the reopening of exports through commercial channels to South Asian countries, Japan and Australia.

The tables below show exports of coal and coke in recent years :

COAL AND COKE EXPORTS (By Land)

	1952-3		1953-4		April—December 54	
	Quantity Tons	Value Rs	Quantity Tons	Value Rs	Quantity Tons	Value Rs
COAL						
Eastern Pakistan	3,49,195	1,25,44,599	3,89,056	1,05,12,840	3,15,923	84,46,465
Western Pakistan	2,37,754	1,18,87,700	3,47,369	1,68,68,450	2,13,638	84,66,294
Total	5,86,949	2,44,32,299	7,36,425	2,73,81,290	5,29,561	1,69,12,759
COKE						
Eastern Pakistan	10,100	4,54,868	17,834	5,81,640	7,864	2,59,147
Western Pakistan	—	—	—	—	6,017	2,42,252
Afghanistan	—	—	—	—	268	16,200
Total	10,100	4,54,868	17,834	5,81,640	14,149	5,17,599
Total of Coal & Coke						
Eastern Pakistan	3,59,295	1,29,99,467	4,06,890	1,10,94,480	3,23,787	87,05,612
Western Pakistan	2,37,754	1,18,87,700	3,47,369	1,68,68,450	2,19,655	87,08,546
Afghanistan	—	—	—	—	268	16,200
Total	5,97,049	2,48,87,167	7,54,259	2,79,62,930	5,43,710	1,74,30,358

COAL AND COKE EXPORTS (By Sea)

Coal		1951-2		1952-3		1953-4		April-December 1954	
		Quantity Tons	Value Rs	Quantity Tons	Value Rs	Quantity Tons	Value Rs	Quantity Tons	Value Rs
United Kingdom	...	1,17,010	41,48,278	—	—	—	—	—	—
Aden	...	55,935	18,80,039	37,807	14,12,898	—	—	—	—
Pakistan, Western	...	1,32,050	42,27,810	81,768	26,73,608	—	—	—	—
Pakistan, Eastern	...	50,927	19,55,760	87,149	50,25,119	2,561	51,220	75,358	19,43,183
Ceylon	...	2,72,109	82,62,454	3,17,710	1,09,48,787	—	—	—	—
Burma	...	1,24,466	45,32,991	2,32,375	88,78,701	2,35,746	75,23,249	1,87,988	56,76,026
Singapore	...	1,12,410	36,26,408	1,14,356	41,38,492	2,78,793	1,04,26,234	1,88,830	62,90,104
Hong Kong	...	1,47,189	48,05,097	1,55,341	57,12,543	43,903	15,49,851	42,917	14,43,086
Japan	...	8,12,776	2,62,65,590	6,04,325	2,15,37,147	1,11,683	38,50,600	78,600	26,56,526
Egypt	...	1,18,449	32,46,055	10,162	3,73,869	3,30,734	1,20,13,868	15,651	5,70,696
Australia	...	1,93,525	59,77,511	1,54,475	52,35,648	—	—	—	—
Other countries	...	2,56,782	91,62,118	2,85,669	1,00,08,887	—	—	—	—
Total	...	23,93,628	7,80,90,111	20,81,137	7,59,45,699	1,77,221	59,57,737	4,11,636	1,21,41,406
Coke	...	33,152	20,85,991	48,591	23,87,165	11,80,661	4,13,52,759	10,00,980	3,07,21,027
Total of Coal & Coke	...	24,26,780	8,01,76,102	21,29,728	7,83,32,864	12,790	7,92,884	11,912	6,52,026
						11,93,451	4,21,45,643	10,12,892	3,13,73,053

The happy situation in the years immediately after the last war, when India's exports extended to distant markets like Finland, Denmark, New Zealand, Italy and Australia—in 1950-1 she was actually carrying coals to Newcastle—did not last long. Countries reorganized their own industry rapidly. Either the abolition or at least a substantial reduction in the export surcharge of Rs 12 per ton on Indian coal might in the circumstances have helped to hold markets longer. Neither was done; and Indian coal found itself soon priced out of the world market. Australia and South Africa offered, and continue to offer, serious competition. Happily, however, the advantages accruing from location are not altogether lost. Coal continues to be exported to Ceylon, Burma, Pakistan and Malaya.

It will be seen that the general level of exports has fallen below the achievements of 1951-2. In large measure, this has been due, not merely to increasing competition abroad as a result of the general lifting of trade barriers, but to several fundamental internal factors. Principally, they are the restrictions on the quality of coal allowed to be exported, the chronic shortage of wagons, the somewhat involved and vexatious procedure imposed by the Government for negotiating contracts with overseas buyers and the innumerable difficulties of Calcutta as a port.

Stimulus to exports can take several forms. The industry has suggested the following :

- (1) A concession on freight on coal for export dispatched in train loads.
- (2) Reduction of the handling charges at the port of Calcutta to the level of similar charges at other Indian ports.
- (3) Examination for quality and size before export.
- (4) A subsidy from the Government.
- (5) Exemption from the excise duty and some of the cesses now levied.
- (6) Assistance from Indian consulates in marketing.
- (7) Consideration of barter as a possible means of promotion.

Exports of coal involve a number of considerations. Because of the need for conserving metallurgical coal it will no longer be possible to export that category in large quantities. It may not be difficult to persuade importers to accept lower grades in view of new techniques of burning low-grade coals in locomotives and steam boilers. Prices quoted should be an inducement, and quality of the highest that the country can sell. Otherwise, there is little hope even of regaining lost ground. Superimposed on these are strategic factors; and there

is the difficulty of equating an extremely fluctuating demand with a somewhat inelastic supply.

The State and the Industry

No survey of the coal industry could be complete without an acknowledgement of the great debt which the country owes to the Geological Survey of India whose work in the direction of discovery of coalfields (e.g. Ramgarh and Singareni), development of coal deposits to the best advantage and estimation of their quantity and quality has been of immense value to the industry. Hardly less meritorious has been the work of the Indian Coalfields Committee of 1946.

The well documented conclusions in their report merit patient study. In the main, their drastic realism does the authors the greatest credit; and the calm temper and generous response with which the conclusions, disappointing as they might have been to oversanguine hopes, have been received not only by the Government but by the industry bear witness to a growth of understanding on which much may yet be built. The Committee suggested several lines of development for the industry; and among them was the establishment of a National Coal Commission to regulate and control the coal industry.

There is control over production, distribution, allocation and prices in the coal industry.

The industry is governed by the Colliery Control Order, 1945, and the Mines and Minerals (Regulation and Development) Act, 1948. Certain sections of the industry have objected to the implementation of the Mining Concession Rules on the ground that they are unduly restrictive.

Protests have also been made against the application of the Industries (Regulation and Development) Act to the coal industry. It would, it is argued, lead to dual control of the industry and consequent confusion. There have been suggestions for bringing the affairs of the coal industry under one Ministry; and not very dissimilar is the suggestion for a separate industrial province embracing the main collieries.

A Coal Mines Stowing Board was created in 1939 under the Coal Mines Safety (Stowing Act), 1939 to administer the fund which is raised by the levy of cess on coal and coke and to spend it on the stowing of coal and other operations to prevent fires in mines and to avoid wastage of coal.

Assistance rendered by the Board comprised :

1. Grant of stowing materials.
2. Loan of stowing parts and means of transport for stowing materials.

3. Monetary grants towards the expenses of carrying out the measures for which the assistance has been granted.
4. Grant of loans for meeting either wholly or in part expenses on the purchase of installations of stowing plants in mines and means of transport for stowing materials.

A scheme of fire watching which the Board put into operation in 1946 is working satisfactorily.

An Indian Bureau of Mines was established in March 1948. Its functions, among others, are the inspection of mines with a view to effecting general improvement in mining methods, conservation of mineral wealth by planned working, recovery of the largest possible quantity, proving of mineral deposits by the use of modern methods of prospecting, advising Governments—Central and State—on questions relating to mineral concessions, royalty, rents, taxation and tariffs, export policies, etc., and organizing research on problems relating to mining.

The Indian School of Mines and Applied Geology, Dhanbad, was established in 1926 and is the only institution in India of its kind imparting high-grade technical education in mining and applied geology.

Knowledge of the composition of coal and of the factors that influence its behaviour when heated is still limited. The ignorance is now gradually being relieved by the investigations of the Fuel Research Institute at Dighwadih. Much analytical and testing work of great industrial value is being done. For instance, the qualities desirable in soft coke are being ascertained more fully, and the potentialities of the coals of the country in this and other respects, including all major industrial uses, are being assessed.

Experiments on a pilot plant scale for the production of iron in low-shaft furnaces using non-coking coal instead of coking coal are contemplated. If the project proves successful, it will help to conserve metallurgical coal. The work of the Institute is not confined to the laboratory; it covers the entire coal area. A comprehensive survey of India's coal resources is under way, primarily with a view to demonstrating how, through washing, the coking qualities of coal could be improved. Five regional coal survey stations have been set up—three in Bihar, one in Madhya Pradesh and one in Assam. A survey of the coalfields of Hyderabad has begun and a survey station in that area seems likely.

The Institute, planned by the Council of Scientific and Industrial Research, conducts inquiries into the washing possibilities of Indian coals, desulphurization of coal and low-temperature carbonization, and

undertakes spectroscopic investigation of fuel problems. It covers all aspects of research on every type of fuel such as coal, petroleum, alcohol, wood-charcoal and gaseous fuels. For the present, however, its activities are largely in respect of solid fuels and coal in particular. Such concentration of fuel efficiency may yield important results; and they will no doubt be reflected in the consumption statistics for the coming years.

A Solid Minerals Fuels (Coal and Coke, etc.) Sectional Committee and a Sampling Sub-Committee and also a Sub-Committee for Standard Sizes have been set up by the Indian Standards Institution. This is the first, and a welcome, step in the direction of standardization, the need for which in India is urgent.

Coal Industry Working Party

A Working Party was constituted for the coal industry in 1950 which was asked to examine and make recommendations to the Government on the following matters :

(a) Measures necessary to achieve increase of production in the industry ; (b) measures for reducing costs of production ; (c) measures for improving the quality of products ; (d) measures to improve the efficiency of labour management and organization of the industry as a whole ; (e) measures to achieve rationalization of the industry ; and (f) measures for better marketing of the products of industry at home and abroad.

The following were some of the important conclusions and recommendations in the Report of the Working Party submitted to the Government in September 1951 :

- (i) The existing control on coal in respect of price, allocation and distribution should continue. Stricter control on the quality and dispatches of all coal and coke is desirable and the cost should be met by the levy of adequate inspection fee on the dispatches of coal and coke to railways and Government consumers. Dispatches below specified standard to consumers should be penalized.
- (ii) Good-quality coking coal should be conserved and for that purpose the Coal Mines Safety Stowing Act should be amended ; use of good-quality coking coal should be strictly restricted to the iron and steel industry, blast furnaces and other metallurgical purposes and the scheme suggested by the Metallurgical Coal Conservation Committee should be implemented.
- (iii) Mechanization provides the only real means of securing quickly and on a planned basis the large increase in produc-

tion that may be found necessary in future with the expansion of the general industrialization of the country. But there are a number of impediments in the way of introducing large-scale machanization in India's coal mines.

- (iv) Some of the main causes for low efficiency of Indian labour are inadequate housing accommodation, absence of proper mining, want of good working conditions, illiteracy, absence of some sort of incentive payment or production bonus being tied to attendance, lack of discipline and labour leadership influenced by political parties. Piece rates should be introduced wherever possible, a production bonus system on a graduated scale should be introduced, and Government and industry should join hands for the large-scale training of workers in operating and maintaining machinery.
- (v) A federation of employers in the local industry of India should be formed to deal with all matters and points of larger issues of employment, wages and other labour matters.
- (vi) Different cesses levied by different State Governments need re-examination and, as far as practicable, uniformity should be brought about by all States.
- (vii) The amount of surcharge to be levied on exports to any country should depend upon the capacity of that country to bear the same.
- (viii) The Mineral Concession Rules should be amended so that the period of lease may be made thirty years, with the option of renewal for another thirty years.
- (ix) Procedure for acquiring lands for coal-mining purposes should be simplified.
- (x) For the administration of State railway collieries, a private limited company or a joint-stock corporation should be formed, the President of the Indian Republic being the 100 per cent shareholder of the company.
- (xi) Legislation should be carried out to enable Government to amalgamate such collieries as may be considered necessary in the country's interests.
- (xii) The Soft Coal Cess Committee should be revived.'

The more important decisions taken by the Government on the recommendations of the Working Party were as follows :

- (i) The existing control on coal will be continued.

- (ii) Powers have been taken by the Central Government by legislation for the conservation of metallurgical coal and a Coal Board has been set up.
- (iii) The Government of India has accepted the principles contained in the recommendations regarding the zonal production and distribution of coal.
- (iv) The recommendation regarding mechanization^o of coal mines has also been accepted. An investigation will be undertaken by the Coal Board in due course, to ascertain the extent to which mechanization can be introduced in the existing mines without any material retrenchment resulting therefrom. When permission for opening new mines is granted, a condition will be imposed that all new developments should be planned and executed, as far as practicable, with the maximum possible use of machines for coal cutting and coal conveying.
- (v) The Government of India attaches great importance to the recommendations regarding the improvement of output per man-shift. Specific recommendations are under examination.
- (vi) The recommendation regarding the creation of a private limited company for the administration of railway collieries is under the consideration of Government.
- (vii) Government accepts the recommendation that a stricter control on quality and dispatches of coal and coke should be exercised. Instructions have been issued to the Coal Commissioner that dispatches of coal below the specified standard to consumers should be penalized.
- (viii) While the Government accepts the principles embodied in the recommendation regarding the production and utilization of lower-grade coal, it considers that any further increase in the production of lower-grade coal will be inadvisable at present in view of the limited transport capacity available.

Prospects

Two conclusions emerge. They are that coal is a vital raw material ; and consequently its production, preparation, distribution and utilization should be rationalized.

Reserves of non-coking coal, according to estimates, are considerable. Economy is being exercised in the use of coking coal.

Production is on the increase. The conflict between internal and external demand has abated, and coal is again being exported.

The present situation broadly is : output 36 million tons ; dispatches 32 million tons ; demand 39 million tons (per year).

The size of the average colliery is not economically the best ; and there are great advantages in large-scale production which are not now being fully realized.

There is no overproduction in relation to demand ; only in relation to transport. Numerous by-products have been brought to commercial use.

Antagonism to mechanization continues. Labour has always been somewhat suspicious of machinery. Not only is there the fear of unemployment but it is thought that machinery increases the risks of what is already a very hazardous occupation.

There is need for speeding up the productive expenditure on replacement and modernization ; and for this, funds are not readily available, for the industry, by and large, is operating just on the margin between profit and loss.

Workers no longer 'burrow in the darkness of a harsh and insecure livelihood'. Present conditions of employment offer a higher standard of living than was the lot of those who toiled in the past.

The wage system is extremely complicated and should be simplified.

Costs and prices have gone their separate ways. The divergence has been apparent for some time, but especially in the last few years. To the extent that this divergence can be traced to intrinsic influences (increases in wages and allowances) it must be expected to continue. The industry remains under strong pressure to economize in other directions. This process of adjustment inevitably takes time.

Transport is a deep-seated disorder and needs drastic remedy. The provision of an adequate number of wagons at the right places at the right times is the primary requirement.

Demand is expected to increase by more than a third during the Second Five-Year Plan period. An assessment is being attempted. Schemes for stepping up output to meet the increased demand are under preparation.

Large-scale replacement of coal by other fuels is not likely in the near future. A reduction in off-take is possible, however especially if the alternatives score over coal in price. True, such highly active sources as the atom may make possible substantial fuel economies ; but atomic energy is not likely to come soon enough to take the load off coal ; and too little is known about it yet to hazard a comparison of its availability for domestic and industrial purposes. The coal industry will endure for many years.

The State is taking an active interest in the industry. Control over distribution, as the Commodity Controls Committee recommended, must continue as long as transport is inadequate.

That conservation, as now conceived and implemented, will effect a social gain is not quite clear. There is at any rate a need for a more judicious application of the measures. Which of the many possible methods of using coal should be adopted in any given case is a much wider question. It depends, not on a simple choice between alternatives, but on the balancing of a variety of factors and often a combination of possible processes.

The industry stands to benefit from research now in progress. Science will no doubt continue to show ways of economizing consumption; and as the years go by, much that is intangible to-day will become established fact.

Finally, there is the question of the contraction in foreign trade. Exports have dropped sharply from the post-war peaks. How far is this to be regarded as a permanent change to which the industry must adapt itself as best it can? How far can the position be retrieved by lower prices or other means? Have we lost trade because of competition? If so, can we hope to recapture the markets, or must we regard them as a permanent loss?

The answer to these questions cannot be precise. Something approaching precision might be possible if a survey were made of the demand for coal, at home and abroad, of the changes in demand and of the causes of those changes. What is clear, however, is that recovery is vital to the industry; and that cannot be achieved unless suitable stimuli are soon forthcoming.

There have been proposals for State acquisition of mineral rights as a step towards nationalization of the coal industry. According to the Industrial Policy Resolution of the Government of India, coal is one of those industries for which the State will be exclusively responsible for the establishment of new undertakings, except where in the national interest it is necessary to secure the co-operation of private enterprise subject to such control and regulation as the Central Government may prescribe. The industry has been much perturbed over the possibility of nationalization. Fresh capital, either for replacement of machinery or for improvements in the technique of production, has not been easy to find. The technical competence of Government to run the coal mines is questioned; and the uneconomic working of certain Government collieries is pointed out as proof. The validity of such arguments as that miners would work harder for the State than for the private capitalist, that nationalization would put an end to strikes and that

when the profit motive was abolished there would be more coal than ever, is disputed.

The nationalization of coal seems impracticable at present. The problem thus remains essentially one of striking a balance between Central authority and private endeavour.

In the context of national interests the importance of these developments can scarcely be over-rated. It is apparent that coal has played, and will continue to play, a leading role in the promotion of industry, upon which the maintenance and improvement of standards of living so largely depend.

CHAPTER VIII

THE ELECTRICITY GENERATION AND SUPPLY INDUSTRY

Just as important as coal, even if its importance is less² fully realized, is the electricity generation and supply industry. Indeed, in certain circles it is regarded as the forerunner of economic development. A remarkable diversity of usage, coupled with the qualities of cleanness and convenience, has enabled it to become an integral part of a great industrial complex; so close indeed is the connexion that a breakdown of electricity supply could bring a large section of industry to a standstill. And perhaps no other form of energy progressively brought to the aid of man lends itself so readily to transmission in large blocks across vast areas and to distribution to a variety of users according to their requirements.

The total capital invested in the public electric supply industry up to the end of 1948 is said to have exceeded Rs 118.6 crores. State-owned undertakings accounted for Rs 56.2 crores and private companies, for the balance of Rs 62.4 crores.

Private companies accounted for nearly sixty per cent of the total electricity generated in the country in 1949.

The generation of electricity in India as an industrial enterprise may be said to have begun in the late nineties of the last century. Installed capacity in 1900 is reported to have amounted in all to only about 1,130 kilowatts. Progress in the beginning was slow. By 1925 capacity had increased to 3,72,152 kilowatts. Almost a trebling of that capacity was achieved in the next ten years. The records of the Central Water and Power Commission (Power Wing), Simla, show that by the end of 1950 installed capacity had increased to 17,12,515 kW.¹ and production to 508.8 crore kW.² In other words, in about 25 years installed capacity had increased nearly five-fold. And by March 1951 installed capacity had further increased to 24,33,000 kilowatts.

Much has been done in this country in recent years to raise the rate of both generation and consumption, but basic data are badly out of date. The handbooks issued periodically by the Central Water and Power Commission, Simla, constitute an attempt to keep pace with

¹ kW.: kilowatt (one thousand watts), a measurement of *power*, i.e. the rate at which electrical energy is used.

² kWh.: kilowatt-hours, a unit of *consumption*, formed by multiplying a kilowatt by the number of hours for which it is used.

developments. The information that the *Monthly Abstract of Statistics*, the *Monthly Statistics of the Production of Selected Industries* and the *Monthly Statistics of the Production of Selected Industries* and the Reserve Bank of India *Bulletin* furnish is at best fragmentary. The *Annual Report* of the Ministry of Irrigation and Power, unlike that of the Ministry of Industry and Commerce, is innocent of any statistical appendices.

The table below shows the number of authorized undertakings in India as at 31 December 1951 and kilowatt-hours generated in that year.

Undertakings Owning Generating Stations

1. State-owned :		
(a) Government	...	177
(b) Municipalities	...	11
2. Companies	...	227
		<hr/>
Total	...	415
		<hr/>

Undertakings Receiving Bulk Supply

1. State-owned :		
(a) Government	...	58
(b) Municipalities	...	23
2. Companies	...	89
		<hr/>
Total	...	170
		<hr/>
Grand Total	...	585
		<hr/>

kWh. in
millions.

1. State-owned undertakings :		
(a) Government	...	2,421.806
(b) Municipalities	...	36.030
2. Companies	...	3,400.567
		<hr/>
Total	...	5,858.403
		<hr/>

From 614 in 1952-3, the number of undertakings, large and small, operating in different parts of India had increased to 684 by January 1955. In both their size and competence there is enormous variation. There are many highly efficient units and others not so efficient. In the result, there is a great variety of systems of supply, prices and standards of service.

The tables below summarize the increase in installed capacity and generation between the years 1947 and 1953.

Installed Capacity and Generation by Ownership 1947

Ownership	No. of undertakings owning Gen. Stns.	Installed Capacity of Generating Plant		Generation	
		As at 31-12-1947 kW.	Percentage of grand total %	kWh. generated in 1947 Millions	Percentage of grand total %
(i) State-owned					
(a) Government	97	487,112	35.73	1,475.944	36.23
(b) Municipalities	14	12,545	0.92	30.877	0.76
(ii) Companies	229	863,608	63.35	2,566.497	63.01
Total	340	1,363,265	100.00	4,073.318	100.00

Installed Capacity and Generation by Ownership 1953

Ownership	No. of undertakings owning Gen. Stns.	Installed Capacity of Generating Plant		Generation	
		As at 31-12-1953 kW.	Percentage of grand total %	kWh. generated in 1953 Millions	Percentage of grand total %
(i) State-owned					
(a) Government	193	928,918	40.3	2,735.591	40.8
(b) Municipalities	15	25,856	1.1	40.089	0.6
(c) Power Corpn.	1	154,000	6.7	84.158	1.3
(ii) Companies	218	1,196,416	51.9	3,837.349	57.3
Total	427	2,305,190	100.9	6,697.187	100.0

Hardly less informative is the statement subjoined showing increase in installed capacity during the years 1951-4.

*Public Utilities — Government- and Company-owned
Installed Capacity (kW.)*

(as on 1 January of each year)

	1951	1952	1953	1954
Steam	10,04,434	10,97,567	11,76,317	13,93,717
Hydro	5,59,285	5,75,179	7,15,179	7,31,179
Diesel	1,48,796	1,62,880	1,70,250	1,80,294
Total	17,12,515	18,35,626	20,61,746	23,05,190

(Break-up and totals tentative)

Obviously between 1952 and 1954 there was an appreciable rise in tempo; an indication that the initial difficulties over procurement of building materials and transport were being gradually surmounted.

The contribution of the two sectors—public and private—is summarized below :

Installed Capacity (kW.)

(as on 1 January of each year)

	1951	1952	1953	1954
State-owned (public sector)	6,27,355	6,98,341	8,82,736	10,86,829
Company-owned (private sector)	10,85,160	11,37,085	11,79,019	12,17,007
Total	17,12,515	18,35,426	20,61,755	23,03,836

(Break-up and totals tentative)

The private sector is still the larger, although the rate of expansion in the other has been very rapid.

A statement showing the capacity and generation of electricity in India during the years 1939 and 1948 to 1954 is subjoined:

Year		Installed plant capacity ('000 kilowatts) as on 31 December	Electricity generated (million kWh.)
1939	...	1,164	211
1948	...	1,411	381
1949	...	1,537	409
1950	...	1,713	426
1951	...	1,835	488
1952	...	2,062	516
1953	...	2,288	559
1954	...	2,305	625

Compared with the increase in installed capacity, the stepping up of generation has been slow, due largely to the delay — unavoidable in some cases — in the construction of transmission lines, substations, etc.

Apart from providing additional power, these power stations are making the best use of national fuel resources; they constitute the main market for the poorest quality coal produced, and their consumption of coal during the years 1948-54 is indicated below:

Coal Consumption by Electric Supply Companies
(in thousand tons)

Monthly Averages

1948	...	160
1949	...	174
1950	...	187
1951	...	195
1952	...	214
1953	...	232
1954	...	223

Electricity produced from coal and oil — sources on which India has depended for many years — is expensive. Expert opinion has it that, both from the point of view of permanency as well as installation and operational economy, it would be best to develop power mostly from water. Thermal stations, it is pointed out, should be limited generally to coal-bearing areas using only low-grade coals, and should otherwise

be installed to serve as nursery stations to build up load in advance of water-power stations. Each unit of 'hydel' energy, it is said, will save about 5 tons of coal per annum and one large-sized hydro-electric project can produce enough energy to run all the railways in India. And water is inexhaustible, whereas minerals are wasting assets. It seems, therefore, that, if cheap power is to be made available for agriculture and industry, there is no alternative to the development of hydro-electric power, not to the exclusion of, but simultaneously with, other sources of energy.

The industry, like any other, exists to supply a demand. The table overleaf summarizes the trend of consumption in recent years.

While the rapid increase in domestic consumption is satisfactory, increases in other directions are no less gratifying. Nearly two-thirds of the electricity sold is being consumed by industry. Textiles and jute mills appear to be the largest purchasers of electric power. And in the near future the metallurgical and heavy chemical industries are most likely to increase their consumption. Expansion of the iron and steel industry and the establishment of a pig-iron plant are presently under consideration. Further, there are plans for setting up a new aluminium plant in the Hirakud area.

Nor will increase in consumption be confined to industry. Agriculture will claim its share of the increased availability. The bulk of the demand is likely to be for large-scale development of tube-wells or surplus water from rivers. And new uses are likely to be found for this source of energy. Processing of agricultural products is but one instance. Cold storage and canning are as yet in the initial stages of development in this country.

A systematic survey of electricity requirements throughout the country under the aegis of the Ministry of Irrigation and Power is contemplated.

Perhaps commonplace, but nevertheless correct, is the prevailing belief that among the principal criteria for determining a country's general standard of living is its power utilization per head of population. *Per capita* consumption varies with countries. For instance, the range within the Commonwealth is from more than 4,282 kWh. in Canada to only about 2 kWh. in Pakistan. The corresponding figure for India is 17 kWh., which is very poor compared with several other countries. This is because electricity has, with some exceptions, not yet reached predominantly rural areas. Most existing installations appear to have been planned — understandably perhaps — to meet the needs of urban areas where extended electrification presented the fewest problems and offered the most immediate returns. Calcutta and Bombay consume between them almost 50 per cent of the electric energy produced in India.

Electricity Consumption

(Figures in millions of kilowatt-hours)

No. of Concerns ¹	Power Generated ²	Domestic Consumption		Commercial Consumption		Industrial Power		Public Lighting	Traction	Irrigation	Public Waterworks & Sewage Pumping	Total
		Heat & Power	Lights & Fans	Heat & Small Power	Lights & Fans	Low-and Medium- voltage Supply	High- voltage Supply					
1948-9	469	4,681.1	51.8	365.5	57.9	186.2	486.1	1,985.8	286.0	131.7	176.1	3,777.7
1952-3	614	6,301.4	97.8	520.7	95.7	254.3	611.4	2,696.2	332.8	220.7	233.0	5,134.3
1953-4	648	6,876.8	120.2	579.0	121.0	262.0	683.8	2,893.9	356.9	229.9	247.5	5,572.7

¹ At the end of the period.² Including purchases from non-electric utilities.

(Source: Central Water and Power Commission)

State Assistance

Primarily with a view to promoting the war effort, the Government created in 1941 the office of the Electrical Commissioner.

Towards the beginning of 1944, despite the preoccupations of war there was growing realization in Government circles, occasioned partly perhaps by the vagaries of the Advisory Boards established by Provincial Governments under the Indian Electricity Act, 1910 — essentially a restrictive and regulatory measure, as apart from developmental — that the objectives of any scheme of electric development for India should be an overall increase in the production of electricity, the generation of an increased quantum of power in the most efficient units and its distribution over a wide area through integrated power systems, and lastly, the development of the electrically backward areas generally and of rural areas in particular. It was felt that even to prepare the way comprehensive Central legislation was needed.

In the same year, the Government of India circulated a set of draft principles for the control of public utility electric supply finance. These formed the basis of the Electricity (Supply) Act, 1948, under which the generation and distribution of electric power in India is controlled by the State. It is modelled on the U.K. Electricity Supply Act, 1946, and is in keeping generally with the modern trend in utility legislation. Among its essential features are the constitution of a Central Electricity Authority and the setting up of Provincial (now State) Electricity Boards. The functions of the CEA include the development of an adequate and uniform national power policy and the co-ordination of the activities of the planning agencies in relation to the control and utilization of power resources. State Electricity Boards are also statutory corporations, and, although subject to overall co-ordination by the CEA, have considerable autonomy and great responsibilities. They are required to co-ordinate and stimulate electrical development by methods leading to a progressive reduction in cost, and exercise a form of financial control on commercially-owned undertakings whereby the investor is assured of a fair return, the industry of adequate capital and the consumer of low rates. This implies working in co-operation and harmony with private enterprise in the industry.

A Central Electricity Commission was constituted in March 1948 and was made responsible for co-ordinating all schemes of electric power development, transmission and utilization throughout the country in consultation with State Governments. Subsequently, it came to be known as the Central Water and Power Commission. It organizes investigations and surveys, carries out research and advises and assists the Central and State Governments on all matters relating to power projects.

Powers of acquisition of private undertakings provided under the 1948 Act are meant to be used only for the purpose of rationalizing supply. Fears of indiscriminate acquisition, once entertained by the industry, have been reduced by repeated assurances from the State to the contrary. The trend, generally speaking, seems to be to exercise options existing under any licence when they arise, if efficiency and economic co-operation can be assured to the public; to pursue actively the development of electricity in areas outside the existing licensed ones as far as possible as a State or quasi-State enterprise; and to grant licences to private individuals for supplying current to isolated towns which have no early prospect of coming under the proposed State regional system.

It is difficult to define with any degree of exactitude the relationship of the industry to the Boards. Reasonably exercised, their powers include little interference with the technical, administrative and, perhaps to a less but nevertheless marked degree, financial aspects of private enterprise.

The Central Government attaches great importance to the early setting up of autonomous Boards. Not all the States, however, have been enthusiastic; understandably, perhaps, in some cases, for they had not the personnel sufficiently qualified technically to man the Boards. A few others contended that the Boards were unnecessary as 'the rationalization of electric supply and distribution had already been achieved through their Electricity Departments'; an approach, in a sense, insular, for it did not suggest an awareness of the larger issue involved: integration of the activities in the States into the national power policy. A third group pleaded financial inability. In consequence, the date set for the formation of the Boards has in several cases had to be extended from time to time. It is hoped that the States where no Boards have been set up will soon take steps to constitute them.

Theoretically perhaps unexceptionable, the Electricity Supply Act, 1948, has in practice proved, in certain respects, difficult. For instance, complaint has been loud and insistent on the standard rate of return — five per cent — allowed. The percentage, it is pointed out, is inadequate to enable even the largest licencees to earn sufficient to service new capital. It prevents, it is added, even the raising of debentures or loans because no funds are available for their amortisation. The Government believes it is only a matter of readjustment, not of loss; the industry thinks that this readjustment cannot be made without loss. Nor could assistance from the Industrial Finance Corporation be had, because the Corporation's rate of interest was higher than the statutory standard return allowed for electricity supply companies.

There has been a demand for the linking of the standard rate with the bank rate in such a manner that the differential is not less than three

per cent, and for provision for deferred taxation reserve. Without these, an adequate flow of development capital, it is feared, will not be forthcoming. Another demand hardly less pressed is for 'clarification of Clause I of the Sixth Schedule of the Act and related amendments to Section 57 relating to the licensee's competency to vary his rates'; in other words, for a confirmation of the grant of complete freedom in the complicated technique of rate adjustment subject to keeping profits within the statutory limit. Amendments to the Act are now under study with a view to bringing electricity legislation more into line with current requirements. Indeed, certain tentative conclusions appear to have been reached. One of them is to enable the industry to avail itself of the benefits of the development rebate permitted under the provisions of the Finance Act, 1955, by allowing the creation of a development reserve. Recent reports suggest a slight upward revision of the standard rate of return.

Rural Electrification

Rural electrification may be said to have commenced in the early 'thirties. Till then, power supply was confined to urban and industrial areas. Prospects of a reasonable return from operations in rural areas were not good enough to attract private enterprise which at that time had a virtual monopoly of the field. And there was no statutory obligation to provide electricity even in remote and 'uneconomic' areas. It was only with the implementation of several hydro-electric schemes by State Governments that a beginning was made in extending the benefits of electricity to the rural population. And gradually the realization grew that, apart from providing amenities like lighting, electric power could be used in diverse ways in rural economic development; notably in the electric pumping of water (where canal irrigation is not available) and in the promotion of village industries. Even so, as late as 1950, only 2,792 villages with a population of less than 5,000 each received supplies of electricity. In other words, only one village out of every two hundred was electrified. In terms of population, only one tenth had the benefits of electricity. The best commentary on what was achieved is perhaps provided by the statistics given below for 1951.

Population	Total number of towns & villages in India	Percentage electrified
Over 1,00,000	49	100
50,000 to 1,00,000	87	100

Population	Total number of towns & villages in India	Percentage electrified
20,000 to 50,000	277	90.25
10,000 to 20,000	607	47.94
5,000 to 10,000	2,367	15.00
Below 5,000	5,59,062	0.54

The table above emphasizes the need for rural electrification, particularly as 80 per cent of the population live in villages. The problem is simpler in countries like the United Kingdom and the U.S.A. where the population is largely urban. In India, the issue resolves itself into finding the material, the men and the money.

Electrification of the entire rural area in India, it is estimated, would cost:

1. Material : 4,00,000 secondary and low-voltage lines.
2. Men : Training of two to three thousand engineers and a much larger force of technical and skilled labour.
3. Money : Rs 600-700 crores.

The inadvisability of undertaking a task of this magnitude in the present circumstances has been realized. Electrification of only certain selected rural areas is to be attempted. Even so, it would appear that the success of the attempt would depend on a number of factors, among the more important being economy in construction and operation through the use of local materials ; devising electrical equipment suited to the needs of the village and adapting the simple power plant and equipment to the requirements of village life ; the manufacture on a mass scale of commonly required equipment, and standardization; a modicum of State assistance in the form of subsidies and the pooling of Provincial experience.

With a view to achieving all possible economy in the execution of rural electrification schemes, the Central Water and Power Commission has undertaken the standardization of transmission and distribution lines for electric supply in rural areas in all States. This has meant a study of current practices in the various States. The optimum use of Indian timber as line supports for transmission and distribution is another of the objectives. As there is no great technical difficulty in extending supplies, it is hoped to be able to standardize designs soon so that some economy may be achieved in construction.

The Planning Commission had in its First Five-Year Plan suggested that States should set up special machinery on the lines of the Rural Electrification Administration in the U.S.A. From the few reports available it seems that very little has so far been achieved in this field.

The capital cost involved in extending the transmission lines and the distribution system over a maze of villages is immense. Indeed, it may be necessary in the case of areas far removed from the major grid schemes to instal, as has been done in Russia, small-sized power plants. Although private enterprise has a valuable role to play, particularly in a country of the size of India where there are numerous areas relatively undeveloped, it cannot be relied upon to effect of itself all that is needed. If nothing more were done than to leave economic forces to 'work themselves out', planning would lose all its meaning. A study of the situation showed that the implementation of only those rural electrification schemes which might be self-supporting would not make for much progress and that a subsidy in some form or the other was essential; a finding borne out by experience of similar schemes in some industrially advanced countries.

Financial assistance for rural electrification was discussed in detail by a sub-committee of engineers who attended the Engineers' Seminar held at Roorkee in July 1954. The following recommendations were made :

- (a) That the Government of India should allot a sum of Rs 10 crores per annum and sum of Rs 20 crores for the remaining period of the First Five Year Plan for the purpose and grant loans to the State Governments on approved rural schemes on the following terms :
- (b) (i) The Central Government should make a contribution up to a maximum of 50 per cent of the capital cost on these approved schemes, and the balance as loans repayable on the usual terms. Alternatively,
- (ii) The Central Government should grant a loan to cover the entire cost of the rural electrification scheme interest-free for a period up to a maximum of 10 years, repayable in 20 years, thereafter, with interest.

The Seminar accepted the recommendations with one modification: it was thought desirable that in place of a capital subsidy, the proposed assistance should take the form of an interest-free loan for a maximum period of ten years, depending upon the merits of each individual case.

The report of the sub-committee, as modified by the Seminar, was considered by the Co-ordination Board of Ministers which met at Delhi

in October 1954. Apart from the general acceptance accorded, the following conclusions were reached:

- (a) Rural electrification cannot be accomplished without the grant of a subsidy.
- (b) Any surpluses from revenue derived from electricity undertakings of the States should be treated as a fund for subsidizing extension to rural areas. If any further assistance is required, the State Governments should draw up their schemes and submit them to the Planning Commission for provision of funds as a part of the States' Plan.
- (c) A sum of Rs 10 crores per year for a period of the next 7 years (i.e. to the end of the Second Five-Year Plan), as recommended by the Sub-Committee, should be allotted for rural electrification in the whole country.

A decision on policy was difficult because the data available from the States about the relative surplus and deficit as between rural and urban areas were inadequate; no proper assessment was possible.

The Planning Commission asked the State Governments to explore the position regarding power more fully, and added that for suitable schemes requiring the installation of thermal sets of sizes ranging from 500 kW. to 2,500 kW. and/or the extension of transmission and distribution lines from existing sources of supply, the Commission would be prepared to recommend the grant of loans by the Central Government. In the case of towns or areas at present served by privately-owned electricity undertakings, the State Governments could advance loans, the Commission said, on the basis of assistance made available by the Central Government.

According to the communication sent, the State Governments were asked to explore the power position with special reference to :

- (a) towns with an existing supply of electricity which are small or medium size (say, with a population of 10,000 to 50,000) which have been growing fairly rapidly and in which employment opportunities could be considerably expanded if additional power could be made available and/or existing worn-out plants could be replaced;
- (b) towns which do not have electricity at present and are not expected during the next four or five years to be included in any grid scheme in which, on account of their situation, communications, local skills or new economic developments in the neighbouring rural areas, employment could be

increased fairly rapidly if small power plants could be provided;

- (c) suburbs of large towns, especially with considerable refugee population, without sufficient work opportunities;
- (d) community project areas in which, on account of existing skills or local resources or new development programmes, employment in small industries could be expanded and in which there is adequate scope for utilizing power in rural areas — for example, in irrigation pumping.

The Central Water and Power Commission scrutinized schemes, costing in all about Rs 20 crores, received from the various States. Those which were to be completed by March 1956 had the approval of the Planning Commission. It was recently reported that the Central Government had sanctioned loans to thirteen States totalling Rs 18.24 crores, repayable over a period of thirty years; a rather belated recognition of the basic need for assistance. An advantage, among others, is that it will increase employment opportunities. Out of the amount sanctioned, about Rs 12 crores are to be spent on schemes for rural areas; this is apart from any sum which the State Governments have set apart from their own resources for rural electrification.

Authority is not resting there. A pool scheme, by which loans in any rural sector would be made up by the profits from the urban areas, is under study. Another possibility reported to be under investigation is to credit certain portions of the proceeds of taxation on the sale of electricity and of the betterment levy on properties which are supplied with electricity, to an Electricity Development Fund.

The southern States of Madras, Mysore and Travancore-Cochin have to their credit a fair measure of rural electrical development. In Madras, over 2,500 villages had been electrified by 1953. In Mysore, nearly 700 villages had been electrified by the end of 1954. Travancore-Cochin aimed to electrify about 800 villages by the end of the First Plan period. In recent years, other State Governments — Bombay, Uttar Pradesh, Bihar, Orissa, West Bengal and the Punjab — have initiated electric power projects in which emphasis is laid on rural supplies. Not only are old and new industries of various kinds in cities and towns being served, but electricity is also being taken, at great cost, to rural areas. It was hoped that by the end of the First Five-Year Plan period all the 1,441 towns in the population category exceeding 10,000, out of the nearly 5,61,000 community groups in the country, would have been electrified and that about 6,500 villages in all would have electric supply. The progress made, however impressive in terms of *per capita* consumption — from 10.11 kWh. on 1 January 1951 to 15.47 kWh.

on 1 January 1954 — was not altogether satisfactory in terms of rural electrification. 6,500 villages represent only about 1.2 per cent of the total number in India.

With an allotment of Rs 75 crores, it is hoped that by the end of the second Five-Year Plan period (1960-1) it will be possible to electrify about 10,600 additional towns and villages.

Hydro-electric Power

India is exceptionally rich in water-power resources. An estimate in 1921 put the hydro-electric power potential of the area now comprising India, Pakistan and Burma at 5.6 million kW. For India, as has since emerged, the figure was till recently thought to be about 3.5 million kW. This estimate has had to be revised in the light of the latest hydrological and topographic information and of improved methods of dam and tunnel construction. The potential is now put at about 35 million kW. The current installed capacity is little more than half a million kilowatts — only about 1.5 per cent of the potential. Clearly, therefore, the efficient exploitation of such immense resources is a matter of vital national concern. A determined effort is being made to harness the energy of flowing waters. A search for more sites for hydro-electric stations has begun. The First Five-Year Plan included programmes for the increased generation, distribution and utilization of large blocks of power and for the harnessing of rivers for power generation. Capacity increased from 5,59,285 kW. in 1950 to 7,31,185 kW. by the end of 1953, and was expected to reach 10,99,400 kW. by March 1956. The objective is to add 11 million kW. of 'hydel' and thermal power to the existing 1.8 million kW. in the next ten years. The completion of the hydro-electric projects now under construction in India should lead to the stepping up of the total installed capacity of electric power plants in India from 24,33,000 kW. in March 1951 to 50,29,000 kW. in 1959.

The Central and the State Governments have since Independence been promoting schemes for power development; most of which are an integral part of combined irrigation and power projects. The Planning Commission provided, out of a total public expenditure of Rs 1,493 crores in five years, about Rs 170 crores for power development. The statement below shows progress in multi-purpose projects and in other power projects in the States.

STATEMENT I — *Progress of Multi-purpose Projects*
Additional Installed Capacity ('000 kW.)

Project	1951-4 Plan	1951-4 Achieve- ment	1954-5 Anti- cipated	5-Year Target	On comple- tion
Bhakra-Nangal	48	..	96	96	144
Harike	..	..	..	..	..
Damodar Valley Project	154	154	154	194	274
Hirakud	..	..	..	18	123
Total	202	154	250	308	541

STATEMENT II — *Progress of Power Projects in the States*
Additional Installed Capacity ('000 kW.)

States	1951-4 Plan	1951-4 Achievement	1954-5 Anticipated	5-Year Target
<i>Part 'A' States</i>				
Andhra	52	14	15	67
Assam	..	..	..	5
Bihar	5	5	7	11
Bombay	67	22	68	83
Madhya Pradesh	73	51	64	73
Madras	111	68	111	111
Orissa	7	5	8	8
Punjab	..	..	..	..
Uttar Pradesh	29	14	79	109
West Bengal	..	..	16	4
Total Part 'A' States	344	179	368	471
<i>Part 'B' States</i>				
Hyderabad	53	..	15	53
Jammu & Kashmir	..	..	6	7
Madhya Bharat	14	4	18	15
Mysore	72	72	72	72
PEPSU	..	..	..	..
Rajasthan	11	12	16	35
Saurashtra	3	..	9	12
Travancore-Cochin	73	9	65	81
Total Part 'B' States	226	97	201	275

States <i>Part 'C' States</i>	1951-4 Plan	1951-4 Achievement	1954-5 Anticipated	5-Year Target
Bhopal	3	3	3	5
Coorg	..	..	..	..
Kutch	..	..	..	..
Tripura	..	..	..	..
Vindhya Pradesh	..	..	..	3
Himachal Pradesh	..	..	..	1
Manipur	..	..	..	..
Total Part 'C' States	3	3	3	9
GRAND TOTAL	573	279	572	755

Progress in power installation can be presented in several ways. For instance, the table below is different from those foregoing; the angle of vision is altered.

Power in '000 Kilowatts

Period	Plan Target (1952)	Actual or anticipated	Percentage achievement	Cumulative progress
1951-3 (2 yrs.) ...	239	397	168	37
1951-3 (3 yrs.) ...	724	437	61	41
1951-5 (4 yrs.) ...	881	705	80	65
1951-6 (5 yrs.) ...	1,082	1,000	93	93

By and large, progress has been satisfactory in Bombay, Madras, West Bengal, Madhya Pradesh, Orissa, Uttar Pradesh, Hyderabad, Madhya Bharat, PEPSU, Rajasthan and Travancore-Cochin. Assam, Bihar, Jammu and Kashmir have to make up some leeway.

So far, the private sector has commissioned about 86,000 kW. of generating plant. In addition to 20,000 kW. commissioned by the Delhi State Electricity Board, the Central Railways have added 24,000 kW. of thermal power at the Kalyan Steam Power Station and expected to add a further 18,000 kW. by 1955-6. The private sector is expected to add about 1,20,000 kW. of generating capacity in the Plan period and 1,70,000 kW. on completion of the projects now on hand. It was hoped that installed capacity in the country would be about 2.9 million kW. by the end of March 1956 and about 4 million kW. on completion of all the power projects included in the First Five-Year Plan. About 50 per cent of this capacity, it was estimated, would be from hydro-electric stations. The programme for power in the First Five-Year Plan forms part of a long-term objective, namely, the creation, in a period of fifteen to twenty years, of power amounting to about 7 million kW.

The immediate programme is expected to add 1.1 million kW. of additional generating capacity.

With a view to determining the extent to which irrigation and power schemes taken up during the first period involved commitments for the future, in 1954 the Planning Commission called for broad details from the State Governments regarding the irrigation and power projects which they would like included in the Second Five-Year Plan.

The following proposals were received.

Andhra	Seven power projects.
Assam	Two power projects and one multi-purpose project.
Bihar	Four power projects.
Bombay	Eighteen irrigation projects and seven power projects.
Madhya Pradesh	Twenty-one irrigation projects.
Madras	Eight new irrigation schemes in addition to the six in progress and eleven power projects.
Orissa	Nine irrigation projects and two power projects in addition to the four already in progress.
Punjab	Thirteen irrigation schemes.
Uttar Pradesh	Nineteen new irrigation schemes in addition to five schemes in progress and ten power projects.
Hyderabad	Four new irrigation schemes in addition to the three in progress and five power projects.
Madhya Bharat	Twelve irrigation schemes and one power project.
Mysore	Seven new irrigation schemes in addition to the four in progress and five power projects.
PEPSU	Tube-well sinking under five irrigation projects and extension of Bhakra-Nangal.
Rajasthan	Twenty-eight irrigation projects.
Saurashtra	Twenty irrigation projects and eleven power projects.
Travancore-Cochin	Five irrigation projects and nine power projects.

Ajmer	Three new irrigation projects in addition to one in progress.
Bhopal	Two irrigation projects.
Coorg	Two irrigation schemes and two power projects.
Himachal Pradesh	Ten power projects.
Kutch	Eleven irrigation schemes and fifteen power projects.
Manipur	One multi-purpose project.
Vindhya Pradesh	Nine irrigation projects.

It is expected that by the end of the Second Five-Year Plan period installed capacity will not be less than 6 million kW. The target has been fixed at 6.9 million kWh. The targets will need to take into account, *inter alia*, the electro-metallurgical and electro-chemical industries included in the Second Plan.

Any precise estimate of the amount of coal that this extra electrical power will displace is, at present, impossible.

The *per capita* consumption, which stood at 13.25 kWh. at the beginning of the Plan, was expected to rise to 25 kWh. by the end of the First Five-Year Plan. The target for the end of the Second Five-Year Plan is 50 kWh. *per capita*.

Surveying the whole scene, two chief lines of advance are discernible : hydro-electric and thermal. This raises the question of the pattern of power development most suitable for India. Until the development of atomic power is an actuality in India, the country must continue to depend on coal, water and oil. The pattern will need to vary with areas, depending on the nature of the power resources available in each. For instance, coal-fed power stations could be located near collieries, and only low-grade coals used. Provided the cost of transmission to load centres is economic, hydro-power could be developed at selected sites. In areas not easily accessible, the use of mineral oil for diesel-engine-driven power would be very useful. Hardly less useful would be, where feasible, a link-up of hydro and thermal power stations. In sum, any plan will need to reckon with a wide variety of factors in order to be satisfactory.

The principal characteristic of the industry, in comparison with other productive and distributive industries, is its diversity. Only for a few purposes is it possible to treat the industry as a whole.

Immense possibilities are inherent in the Damodar Valley project. Apart from the generation of hydro-electric power, the abundance of coal in the Damodar Valley facilitates the establishment of thermal

stations. The first to be erected was the Bokaro thermal station. It is proposed to use coal with high ash content in the thermal stations, and 'hydel' power to run the electric railways in the area. The saving in high-grade coal through these two measures should be considerable. Electrification of coal mines with a view to increasing coal output and reducing unit cost is also contemplated. With the elimination of floods and assurance of ample supplies of water and power, there should be plenty of scope for industrial development. Among interesting possibilities are electro-chemical industries.

The discovery of lignite in a district of Madras has aroused the hope that a large thermal station can be established in the south, using lignite as fuel to supplement the hydro-capacity of Madras, Mysore and Travancore-Cochin.

The implementation of projects is conditioned by such factors as :

- (i) Want of adequate technical personnel.
- (ii) Incomplete investigations in the first instance resulting in changes in design, revision of projects and cost estimates and substitution of schemes.
- (iii) Time involved in obtaining administrative approval and sanction of funds.
- (iv) Delay in delivery of essential construction materials, steel structures, equipment and generating plants from abroad.
- (v) Lack of transport facilities.
- (vi) Delays in securing formal permission from departments concerned for certain works, e.g. railway crossings.
- (vii) Delays in obtaining from indigenous sources materials for transmission, distribution and other works owing to lack of adequate capacity of indigenous manufactures and restrictions on their import.
- (viii) Opposition from local people to the acquisition of land.

In July 1954 a Technical Personnel Committee was constituted to make an assessment of the technical man-power position in the country.

In the same year, to facilitate quick action, a high-level policy-making body called the Co-ordination Board, consisting of the Central and the State Ministers of Irrigation and Power, was also constituted.

The Central Water and Power Commission has been strengthened to cope with the additional work entrusted to it in connexion with flood control, the drawing of specifications of plant and machinery required for river valley projects, and their standardization. The Commission

continues to keep itself informed of the progress of major power development projects in the country and of the power availability and power demand position in the various States. Studies on the regional co-ordination aspects of power projects have been undertaken. The Commission also still functions as the sponsoring and recommending authority for the allocation of steel, cement, coal and other controlled materials to the power projects and public electric supply utilities.

Till recently there was no attempt at an economic evaluation of the water-power resources of the country. In 1954 a Hydro-Electric Directorate was constituted to make a systematic assessment of the water-power potential of the country. So far, studies have been made of the hydro-electric resources of the east-flowing rivers of Southern India, the west-flowing rivers of the Western Ghats and the rivers of the Central plateau. The data collected, it is reported, 'are serving as very useful guides in selecting various hydro-electric sites'. These studies are to continue until all the river valleys are covered and a reasonably accurate estimate of the country's hydro-electric potential is possible.

The overall picture is one of a gradual building up of administrative machinery to plan and carry out an integrated programme of power development in the country. Present circumstances call for a fresh assessment of the major power projects all over the country so as to transform these generalities into specific schemes of development capable of efficient and economical execution within the limits of India's physical, financial and human resources and to guard against a possible disequilibrium between power production and its wise utilization. There is no information yet of priorities among the various projects. It is believed that projects under execution will be allowed to go forward and that smaller ones may be considered within the next two or three years.

To utilize the large blocks of power proposed to be created by the projects listed above, large quantities of manufactured goods for the transmission and distribution of energy will be required. Developments in the field of manufacture of electrical engineering goods are as yet far from commensurate with resources. The possibility of setting up a heavy electrical plant manufacturing industry in India is under study. The Central Water and Power Commission has furnished data on the requirements of power plants in the country in the next fifteen years.

The utilization of the large blocks of power likely to become available will also require careful planning. The expected demand has to be clearly envisaged and the supply made to keep in step with the load development. A more balanced distribution of electric power among the various areas should help to promote industrial production. Indeed, the

whole programme will need to be brought into line with the scheme for industry in the Second Five-Year Plan.

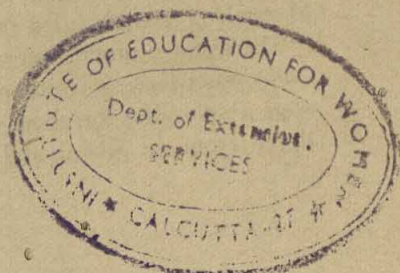
In regard to rural electrification, although much yet remains to be done, the experience of recent years has been encouraging. Under the Plan, large blocks of power will be made available to rural areas and the State Governments are taking steps to ensure that the villagers are enabled to use this supply to the best advantage.

There have been suggestions for the building up of a national grid for India; in other words, for facilitating the interchange of energy between areas by connecting the main power stations for mutual support and advantage. As the antecedent conditions have yet to be realized, it is perhaps wise to desist from making forecasts. At any rate, it is not a factor of immediate practical importance. All that can be said with safety is that a national grid would be difficult to achieve in view of the distances involved; and hence possibly impracticable for some years.

In essence, the Electricity (Supply) Act is an experiment in mixed economy. Demands there have been from electricity supply companies for safeguards to compensate for the loss of operational freedom. But they were based, as often as not, on purely hypothetical considerations which receded more and more from reality with the passage of time. On the other hand, doubts have also been expressed as to the efficacy of 'remote control' and there has been criticism of the division between control and ownership.

Will this form of control — a compromise between nationalization and private ownership — merely combine, it is asked, the defects of both with the merits of neither? Will it remove the advantages of individual enterprise without giving full responsibility to the State? Yet despite its shortcomings, the system seems to have worked satisfactorily.

The efforts of private electricity supply companies, no less than those of State-owned undertakings, viewed in terms of the increased volume of electricity supplied, are profoundly impressive. Further expansion is in prospect. A statutory framework has been built in which operational considerations and consumer requirements have been judiciously fitted. The production of electrical utilization goods has increased and the possibility of installing plant in India for the manufacture of electrical machinery is under examination.



CHAPTER IX

THE PETROLEUM INDUSTRY

Origin

THE expansion of refinery capacity, the more intensive search for new oilfields and the possible establishment of a synthetic fuel oil plant in India reflect the role of petroleum in the national Plans.

To the Assam Oil Company must go the credit of being the first in the field. The story goes back to 1899 when the company took over the oil leases of both the Assam Railways and Trading Company and the Assam Oil Syndicate. Another important year was 1921, when the Burmah Oil Company assumed control. With experience extending well over half a century, the activities of the company embrace all operations from prospecting to distribution. Since their refinery — the first in India — went into production at Digboi thirty-five years ago, a steady supply of over a hundred different kinds of petroleum products has been maintained. Early in 1954, Digboi's output was 1,80,000 gallons a day. Consequent on the discovery of new deposits in the neighbourhood, the figure has risen to 2,50,000. The company has plans to increase production to 3,00,000 gallons.

Relatively recently two more refineries — the Standard Vacuum and the Burmah-Shell — have gone 'on stream' and a third — the Caltex — is being built at Visakhapatnam; the three costing in all about Rs 63 crores so far — perhaps the biggest investment in a single industry in India within so short a time. Together they will have a throughput capacity of about 38,75,000 tons of crude oil a year; an impressive figure by any standards. Added to the output of the Assam Oil Co., Digboi, production will perhaps just about balance requirements; a remarkable development in our industrial history. And that is not the end of endeavour. A most determined bid is under way to find new oilfields in India.

Indigenous supplies in undivided India came from the oilfields in the North Punjab and North Assam. On the partition of the country, the oilfields in the North Punjab went to Pakistan. The Indian industry in oil was thus confined to a relatively small area in North Assam. Mineral oil was obtained mainly from the Digboi oilfield.

The average production of petroleum in India for the years 1929 to 1938 was nearly 66 million gallons, out of which the Assam oilfields were responsible for about 57 million gallons, the balance being produced from the Khauf and Dhulian oilfields in the Attock district of

the Punjab, which is now part of Pakistan. Production increased to about 80 million gallons immediately prior to World War II. Petroleum production amounted to 6,48,77,535 gallons in 1946; 6,51,92,235 gallons in 1947 and 6,56,07,982 gallons in 1948. Output till recently was practically stationary at about 65 million gallons. Accurate figures are not available. Peak production was in 1943 when, taking 1937 as base year 100, it reached 200 per cent. On the same basis, the percentage works out to 134.7 for 1946; and slightly higher figures for 1947 and 1948.

There has been, and is still, extreme disparity between India's oil assets and oil needs. Pre-war, Burma supplied about 35 per cent of India's requirements. Indigenous sources provided about 13 per cent, and the rest came from the Middle East, the East Indies and the U.S.A. During the war, allocations for India were made by the British Government. Considerable quantities of petroleum were imported from all available sources for the prosecution of the war.

Imports in the post-war period have in the main been from Middle Eastern countries such as Iran, Iraq, Muscat, Bahrein and Kuwait.

In 1948 India was constrained—the closure of the Haifa refinery was in the main responsible—to import part of her requirements of motor spirit, kerosene and high-speed diesel oil from dollar areas. This meant a relatively heavy drain on the rather slender dollar resources of the country. Efforts were made to divert the demand to the sterling area.

Substitution Scheme

The Government of India adopted the Oil Substitution Scheme, which contemplated the substitution of oil imported from U.S.-controlled production sources by oil from sources controlled by sterling oil companies. Supplies of the major petroleum products for the calendar year 1949 were almost entirely from the sterling area. But even from the sterling areas unlimited supplies could not be afforded. A ceiling had to be fixed for imports from sterling sources as from 1 July 1949.

Devaluation necessitated a total ban on imports other than lubricants from dollar areas; and, even in regard to lubricants, which were being obtained chiefly from the U.S.A., attempts were made to switch as far as possible to soft-currency countries.

From 1 January 1950, it was found possible to allocate more foreign exchange for petroleum products.

The world situation improved towards the end of 1949. The output of crude oil in 1950 was about 52,40,00,000 metric tons; and in 1951, despite the stoppage of operations in Iran, output increased by

7,00,00,000 metric tons over the previous year to reach a new record of nearly 59,40,00,000 metric tons. It became possible to arrange for increased supplies of all petroleum products. Supplies of kerosene had been short of requirements for a number of years. The import allocation for the commodity was increased and larger quantities entered the country.

Till November 1949, imports from Middle Eastern countries were under open general licence. Since then, arrangements have been made to import regulated quantities to meet the country's requirements.

Imports

Imports in the last few years have been:

	Kerosene	Fuel Oils	Lubricating Oils	Petroleum*
1952-3				
Quantity (gallons)	26,77,09,735	31,76,97,676	6,10,76,476	24,82,61,676
Value (rupees)	21,85,34,741	14,91,34,572	13,10,80,395	25,92,28,443
1953-4				
Quantity (gallons)	29,91,37,017	36,19,51,729	3,79,69,951	26,96,74,238
Value (rupees)	27,48,23,004	18,87,26,214	6,03,48,219	30,89,67,785
1954-5				
Quantity (gallons)	31,02,82,298	34,60,06,583	56,37,17,715	21,49,32,406
Value (rupees)	28,66,66,649	19,14,97,416	8,70,21,006	24,98,36,170

* Dangerous, flashing below 76°F., including petrol, benzine and benzol, motor spirit (including aviation spirit) and other sorts.

India spends about Rs 75 crores per year on imports of mineral oil.

The Agreements

The present attempts to increase capacity and production appear to have stemmed primarily from the Abadan debacle. Indian production of oil was only about 7 per cent of the country's requirements. With industrialization, an ever increasing proportion of foreign exchange had to be earmarked for petroleum imports. Such dependence on outside sources of supply (a major war would have altered the whole supply position), such strategic vulnerability, could no longer be allowed to continue.

The Government of India had had under consideration for some years the question of setting up petroleum refineries. It was realized early that while new oil-bearing areas might exist in the country — the results of exploration had not been very encouraging — their discovery and exploitation would require detailed work for years; at any rate they offered no immediate prospect of supplying the country's requirements of petroleum.

In 1948, at the request of the Government of India, a Technical Mission appointed by the oil companies operating in the country came out to India for an 'on-the-spot' study. It visited Bombay, New Delhi, Calcutta, Madras, Visakhapatnam, Nagpur, Baroda, Ahmedabad and Bhavnagar. A survey of possibilities showed that the setting up of oil refineries in India was technically possible. The Mission recommended — the report was submitted in 1949 — Bombay and Visakhapatnam as the most suitable places for refineries. Agreements were entered into with the Standard Vacuum Oil Co. Ltd., the Anglo-Saxon Petroleum Co. Ltd. and the Burmah Oil Co. Ltd., and with Caltex (India) Ltd. for construction.

To facilitate both the Stanvac and Burmah-Shell projects, the Government of India gave certain assurances to the oil companies; the refineries will be exempt from compulsory nationalization for a period of 25 years, and from certain provisions of the Industries (Development and Regulation) Act. On their part, the oil companies assured the Government that the refineries would be completed as early as possible, that an adequate number of Indian personnel would be trained in refinery operation and that by-products of the refinery would be made available to Indian industries. They will use imported crude oil, but are committed to using Indian crude if and when it becomes available. Power for the two refineries at Bombay will be supplied from the Bombay-Poona grid system.

As with the other two agreements, Indian investors will be able to subscribe to the cumulative preference stock of Caltex (India) which will represent 25 per cent of the issued capital. The ordinary shares will be owned by the oil company. The company has also given assurances for the training and employment of Indians, the use of Indian tankers and the provision of housing for labour. The source of crude oil for the refinery is not yet decided, but the company will be free to make its own arrangements for importing crude and also for distributing refined products in India.

The Standard-Vacuum Refinery at Trombay Island near Bombay went into production in July 1954. This refinery has a throughput capacity of about 1.2 million long tons per annum and the refined products obtained are motor gasoline, kerosene, diesel oils and furnace oil. The total investment in this refinery, including working capital, is about Rs 17.5 crores. It is being operated through a new company, Standard-Vacuum Refinery Company of India Ltd., which has been registered in India.

The Burmah-Shell refinery went into pilot production at the end of January 1955, and into full production in March 1955. This will be the largest of the three new refineries, having a throughput capacity of

2.0 million long tons of crude per annum. Besides other products, Burmah-Shell Refinery will produce bitumen to meet almost the entire requirements of this item. The total investment in this refinery will be of the order of Rs 33 crores. It is also being operated through a new Indian company, Burmah-Shell Refineries Ltd.

The last to go into production will be the Caltex refinery at Visakhapatnam. Preliminary work in this connexion is now in progress and construction is well under way. The refinery is expected to be in operation early in 1957. The throughput capacity as originally planned was 5,00,000 tons of crude oil per annum with an estimated capital outlay of about Rs 7.5 crores. Government later approved the increase in capacity to 6,75,000 tons at an estimated cost of Rs. 12.5 crores. A new Indian company has been constituted to construct and operate this refinery also.

A wide range of petroleum products will be available. It is estimated that from a crude oil intake of 20,00,000 tons per year, the Burmah-Shell refinery will produce 156 million gallons of motor spirit, 72 million gallons of kerosene, 37 million gallons of high-speed diesel oil, 33 million gallons of light diesel oil and 160 million gallons of furnace oil. In addition, it will produce about 1,50,000 tons of bitumen per year. The Standard-Vacuum plant will have an annual output of 90 million gallons of gasolene, 40 million gallons of kerosene, 59 million gallons of diesel oils, 58 million gallons of industrial fuel oils and 49 million gallons of bunker fuel. The Caltex production details are not yet available but on the basis of their annual intake of 6,25,000 tons of crude oil, their output will be about half that of the Standard Vacuum plant.

All the three agreements are basically of one pattern; a happy compromise between State control and operational freedom, and fully in accord with the Industrial Policy Resolution of April 1948 as amplified in the Government Memorandum issued in December 1954. In the mixed economy postulated by the Resolution it was stated that the development of certain basic industries vital to the economic life of the country and, to a certain extent, its security, had to be reserved to the State, as the ultimate custodian of the public interest in a democracy. The fact that this reservation has been made, the Memorandum pointed out, 'does not in any way mean that the private sector cannot be asked to co-operate or foreign interests allowed to participate in them so long as it is clear that the controlling interest is held by the State'.

Embodied in simple and straightforward terms, the agreements provide a firm foundation for a fruitful partnership. Among the more

welcome features are the association of Indian capital in the enterprise, a preference for soft currency sources for the purchase of raw material and construction equipment, and the purchase of crude oil at world prices prevailing at the time and place of shipment, with freedom of choice as to the source of supply. Hardly less welcome are the assurance by the Government of adequate railway transport, and the assurance by the oil companies that they will make the by-products available at reasonable prices to those engaged in the manufacture of chemical products. Particularly notable items from the long-term point of view are the preference given to the purchase of crude oil produced in India, the use of Indian tankers when available, the freedom to change the relative proportion of the products manufactured provided that the output of kerosene is not substantially lowered thereby, and the training of Indian personnel in the techniques of oil refining.

The basis has been laid for a long-term relationship — equitable and constructive for both sides. And as a record of Indian international obligations in the industrial field, the agreements assume a high significance. For one thing, they imply the existence in India of a suitable economic and political environment for the expansion of petroleum production. Clearly, in a contract of this kind, with an investment so immense, weight should be given more to the evident intention of the parties concerned at the time the contract was made than to the words actually used. A sound governing concept for the future is that it would not be in the interests of India to push her revenues beyond the point where operating companies are still willing to take risks and make outlays. A country that does so will lose in the end. At the appropriate time it should be possible to say that both parties have discharged their responsibilities in a completely lawful and proper manner.

This economic partnership between Western industrial skill and an Asian country is just the sort of imaginative departure which, looking far ahead, may prove the start of a new constructive West-East economic relationship; it may set an example which will cause new national Governments in other parts of Asia furiously to think. Indeed the agreements may in good time crystallize into settled and certain rules of conduct. In international, as opposed to internal, dealings, the law is far less certain, far less precise. There are several ragged ends and unfilled blanks; much that is merely tentative and exploratory. All the more important therefore, for the future, is the respect for sanctity of contracts, particularly in the context of current partiality in some quarters for retroactive legislation.

If the basic assumptions of the plans under implementation prove to be true, a total refinery throughput capacity of 38,75,000 tons a year is the minimum level at which the industry is likely to be operating in

the next few years. From the last ten, India, on completion of these projects, will move into the first twenty of the fifty countries with refining facilities. Small though the capacity may be in relation to world production, its development has been on lines as up-to-date as any in the world. Construction involved a large number of very intricate problems and called for a high degree of co-ordination, both administrative and technical. Handling facilities had to be quickly adjusted and improved. The advantages of 'home refining' will be largely lost unless such facilities (e.g. for receiving and discharging large oil tankers) are at all times available to the refinery at moderate charges. The responsibility for making such facilities available rests primarily on the Government of India, although there are many development projects in which the petroleum companies could collaborate.

Demand

Since the First World War there has been a decreasing dependence on coal for power. Other sources — oil, water and gas — have been drawn upon with substantial results; and among them oil has been the most important. In 1920, oil and natural gas supplied only about 15 per cent of the world's total energy; today they provide 50 per cent. The shift in demand has not been without reason. Oil has numerous advantages over coal and they were recognized early. Uniformity of quality, convenience of storage and handling, less loss through wastage and relative ease of temperature control were among the major inducements. The use of oil to generate energy in one form or another is only part of the usefulness of this versatile raw material from which a multiplicity of other products are derived. In its wise utilization, for instance, lies the promise of a flourishing petroleum chemical industry.

In India, although the changeover from coal to petroleum has not been as rapid as in some Western countries, it seems now to be rapidly gathering momentum. The use of furnace oil for power generation in some of the cotton mills of Bombay and Madras and in locomotives on sections of the railway track in South India are but two of the many instances.

Consumption of petroleum products in India before the war amounted to about 2 million tons a year of which nearly 9,00,000 tons were kerosene and only about one third of that quantity petrol. During the war, total consumption (civil and military) rose to a peak of 5 million tons in 1945.

In 1930-1 consumption of petrol in India was 6,46,00,000 gallons. In 1936 consumption, including military consumption (excluding petrol for aviation purposes) had increased to 7,92,89,000 gallons. By 1946 it had reached 14,41,30,000 gallons. Sales of petrol for civilian use

in India amounted to 12,95,29,000 gallons in 1947, 11,52,04,000 gallons in 1948 and 15,23,10,000 gallons in 1949.

Requirements of petroleum products in tons in 1950 were as follows : Aviation and Motor spirit, 7,74,000; Kerosene, 9,08,000; Diesel oil and Fuel oil, 1,37,000; Lubricating oil and other products, 1,77,863; Total, 31,77,063 tons. Present consumption of mineral oil — kerosene, motor spirit, aviation spirit, lubricating and diesel oil — requires an annual production of about 50 lakh tons of crude oil.

With accelerated industrialization — the term 'industry' does not describe a homogeneous entity but rather a widely varying range of processes with a differing range of applications of fuel — an increase in the offtake of petroleum was inevitable. In fact, the decision of the petroleum companies to undertake such a vast capital expenditure rests upon the assumption of a constantly expanding demand for petroleum and its products; and, as for the Government, the budget discloses a certain willingness to risk a modicum of internal economic instability in the interests of vital development. A rough gauge of the annual demand by 1956 is 4 million tons. Consumption (inclusive of all types of fuel oil) is expected to increase by about 75 per cent (that is, to about 7 million tons per year) by the end of the Second Plan period.

This diversion of demand from coal to oil needs to be closely watched for its possible de-stabilizing effects on the general energy market. However essentially complementary rather than competitive, over most of the industrial field coal and oil may often present themselves as possible alternatives. As far as any forecast at all, in a period of rapid technological advance, as to developments a few years hence is possible, the fear of a serious attrition of the Indian coal market appears unwarranted, except, of course, in the event of a quite revolutionary change in fuel utilization, such as any unexpectedly early use of atomic energy on a large scale might bring about.

Several sources of power, although limited in themselves, promise to be capable of sufficient development to make a substantial, though by no means overwhelming, contribution to world needs. The atom is one of them, but no large-scale development within the next few years of the commercial use of atomic energy for heat and power is expected. The world, it seems, must, in the main, rely for its rapidly increasing needs on a careful husbanding of the reserves of fuels like coal and oil, the avoidance of every kind of waste, and the more efficient use and development of the known sources of power.

This emphasizes the need for a co-ordination of fuel policy. The objective should be to achieve the use of the best and most rational type of energy for any given purpose; in other words, to seek outlets for coal and petroleum where their respective inherent advantages can best

be realized in use. This would entail detailed field inquiries into the relative merits of petroleum and other forms of fuel in specific applications, together with a wide dissemination of results. Co-ordination would abate rather than promote competition.

The digestion of the increasing output is not likely to be difficult; consumption is closely dependent on the level of general industrial activity. For optimum advantage, however, the establishment of closer working relations, particularly at the technical level, between engineers from the petroleum industry and the petroleum-consuming industries with a view to devising new and more economical ways of using petroleum, adjusting plant specifications, and changing, where appropriate, designs, or devising, where feasible, improved methods of production are fundamental.

Regulation and Development

The industry is governed by the Mines and Minerals (Regulation and Development) Act, 1948, which empowers the Central Government to regulate mines, oilfields and mineral development on the lines contemplated in the Industrial Policy Resolution of 6 April 1948. Petroleum Concession Rules under the Act came into force on 5 January 1950.

The Petroleum Division of the Ministry of Production is the co-ordinating executive authority in India for all users—civil and military—on all policy questions connected with the supply of petroleum products of all kinds, e.g. provision, search, location, transport, distribution, etc. It determines the allocation of petroleum products to the civil market, decides about imposition, retention or removal of controls and rationing, and, in the case of motor spirit and kerosene, advises the Transport Ministry and State Governments respectively of the quantities to be released. In the case of other products, it administers such controls as may be found necessary.

A Petroleum Advisory Committee has been constituted to consider all problems relating to the petroleum industry in India.

Few commodities in India in their availability and price have been more responsive to overseas developments than petroleum and its products; not unnaturally because there was wide disparity between the country's oil assets and oil needs. Supply was largely from abroad. The closure of the Haifa refinery, devaluation, the cessation of supplies from Abadan and the oil strike in the U.S.A. have all in their day had their repercussions on the Indian market. For the last few years, the lowering of price levels has been the fundamental objective. It has been sought to be achieved in several ways. An oil substitution scheme was evolved and implemented. Essentially, it was an attempt to relieve the possible

heavy drain on dollar resources by diverting the demand to the sterling area. And in the sterling area itself, to avoid the payment of higher freight charges, possible availability from nearer sources was explored, and where found, availed of. Extra freight, where inescapable, was treated as a surcharge and credited to a special account. Procedure was evolved to equate periodically the recoveries to the actual extra freight. To these measures chiefly must be attributed the current progressive reduction in prices; and nowhere has this been more welcome — the criterion being the cost of living of the common man — than in the kerosene sector. Recent developments suggest a broadening of this happy trend.

Home refining is not likely, however, to have any effect on prices, which will keep pace with the cost of importing, refining and transportation. No great relief to the consumer is likely; primarily because the crude oil will have to be bought in the world market. And the economies possible in one country cannot necessarily be achieved to the same degree in another where the factors governing raw material supplies, operating techniques, markets for finished products and labour conditions may be entirely different.

The effect on the economy of a large and expanding refining industry needs no emphasis. There will be decreasing dependence on a single source, as crude oil obtained from any of the world's oilfields can be fed in. Crude oil is more readily available than the refined products. As it costs less to import crude than refined products, clearly the country's balance of payments will benefit. There will be a gradual diminution in the outlay of foreign exchange, which now averages Rs 75 crores a year. Moreover, the new plants will help to mitigate unemployment and, the companies being incorporated under Indian law, direct benefits to the Indian exchequer in the shape of taxation are also likely to be considerable.

An advantage in home refining is that it ensures production based on home, as apart from world, requirements. The proportion of the different products obtained can, within narrow limits, be varied according to demand. As her refining capacity expands, India will be able to increase her production of petroleum by-products, many of which are now imported from the dollar area. And when she succeeds in tapping enough crude oil within her borders, the position will further vastly improve.

The possibility of commanding a fuel with such advantages as petroleum will allow the building up of industries which are only waiting to be assured of supplies of heat and power in order to expand. The by-products could be used in a variety of chemical industries. Indeed the basis for a modern petro-chemical industry will have been laid. Thus,

in steadily growing volume, petroleum will help to promote industrial activity.

Apart from the financial contribution, from the social point of view it may mean the creation within the country of a pool of skilled workers of all grades. At a time when we seem to be on the threshold of immense industrial advance there is a pathetic scarcity of technicians and skilled operators — of that kind of executive talent which combines technical skill with administrative capacity. The companies bring with them the best of equipment and techniques. Training programmes for Indians in all phases of refining are under way.

In the second half of 1955, India, for the first time, exported motor spirit and furnace oil. As there was a surplus, about 78,800 tons of motor spirit and 1,23,000 tons of furnace oil were sold. The destinations were Pakistan, Burma, the Philippines, Australia and Ceylon.

Exploration

The country's oil expansion programme is not confined to the augmenting of refining capacity. India is deeply interested also in finding new fields within her borders. There is a gradual depletion of present resources. The deepening of wells is not satisfactory as a long-term measure. The results of recent investigations suggest that the present known resources are not the whole of India's oil wealth. In all-likelihood, there is more; but where and how deep are the primary questions. Accidents like 'elephants plodding into camp with oil on their feet' obviously cannot be depended upon for an answer: nor indeed magic twigs and divining rods. An intensive programme of exploration, involving geological and geophysical surveys and experimental drilling, has begun. Expert opinion has it that we must look to the regions fringing the peninsula for possible occurrences. More precisely the prospective areas are:

1. The foothills of the Himalayas extending from Kashmir through Kangra, Uttar Pradesh, West Bengal, Assam, Manipur and Tripura.
2. The Western Desert of Rajasthan, Kutch and possibly Saurashtra.
3. The Indo-Gangetic alluvial plains extending from the Punjab to West Bengal.
4. The alluvial tracts of Gujerat and the East Coast.

Apart from the above there are, it appears, possibilities in the Sundarbans, at the bottom of the sea, in the delta up to the eastern Orissa coast, in areas immediately under the sea in and around the Gulf of

Kutch, in Cambay, and in some areas in Madras, Andhra and Travancore. New knowledge and improvements in the technique of exploration will increase recoverable reserves.

Prospecting for petroleum is a notoriously costly proposition; much costlier, for instance, than prospecting for coal or manganese. An exploratory well costs, on an average, about Rs 30 lakhs; and only one 'wild-cat' in fifty is a success. In particular, the cost of drilling in difficult territory to depths of 10,000 feet or more is exceedingly high, and consequently places a limit on the number of structures which can be tested within a given period.

India on her own does not have all the 'risk capital' for ventures of this kind, nor indeed does she have the technical 'know-how'. Foreign participation in both exploration and exploitation was fundamental for success in operations, and that has been forthcoming.

As a result of the efforts of the Assam Oil Company, petroleum has been found in the Nahorkatiya area in Upper Assam. It is expected that during the next few years twenty-five per cent of India's oil requirements will be met from that State alone. Among early possibilities suggested are the expansion of the Digboi refinery, the setting up of a refinery in Calcutta, and the utilization of this oil by the projected Caltex refinery. Extravagant hopes about these discoveries may not be realized; but the presence of oil, if in commercial quantities, would without doubt be a source of greater economic strength. After completing an aeromagnetic survey, the company started geological work in Upper Assam. Drilling operations in the Nahorkatiya area continue. It was proposed to form in March 1956 a new rupee company for oil prospecting in Assam, the Government being assigned a one-third share in the capital, the balance being found by the Assam Oil Co. Ltd. As in the agreements with the other oil companies, there will be provision for the employment, wherever possible, of Indian personnel, and for the training of Indian nationals in India and abroad in all phases of the operations.

Another important development was the conclusion in December 1954 of an agreement between the Government of India and the Standard-Vacuum Oil Co. for joint operations in the exploration and production of petroleum in West Bengal. The preliminary results of surveys were encouraging, but it is yet too early to say whether or not there is oil in commercial quantities. Further testing is under way, and will continue for some time at least, to ascertain the strength of the new finds. One show of oil does not make an oilfield.

In response to an invitation, Russian oil experts came to India late in 1955. According to reports, there was no intention of utilizing their services in oil or mineral surveys; they were to study the organization

set up by the Government and suggest improvements. The provision of equipment and technical assistance for drilling is a possibility.

Paralleling these developments is the setting up by the Government of India in March 1955 of an Oil and Gas Division in the Ministry of Natural Resources and Scientific Research. Essentially its functions are to carry out geological and geophysical exploration for petroleum, to undertake exploratory drilling work at places indicated as favourable and to train Indian personnel in all techniques of oil survey and exploration. Foreign help in overcoming technical personnel difficulties has been sought. Subject to control by the State, the co-operation of private enterprise is welcome. The Division started work in Jaisalmer in Rajasthan and in Saurashtra, where geological investigations suggest the occurrence of oil. The extension of operations to six areas in the sub-Himalayan belt is contemplated. In addition to the original allocation of Rs 1 crore, the Planning Commission sanctioned a sum of nearly Rs. 3 crores as part of the First Plan to strengthen and expand the Geological Survey of India and the Indian Bureau of Mines. It is estimated that by the end of the Second Plan at least Rs 30 crores will have been spent on the exploration of mineral resources; nearly half of which will be spent on oil. While foreign companies who have spent large sums on prospecting for oil will be permitted to continue to exploit their leases, any new sources discovered are to be exploited directly by the State. Though relatively large in relation to Indian resources, the investment proposed still falls far short of requirements and the continuation of operations at that tempo will depend on such imponderables as the size and quality of the discoveries.

Wisely there has been no exclusion of foreign assistance either in finding new fields or financing exploitation. The current programme of intensive exploration may bear fruit in the future. Time and further investigation alone can show the ultimate extent of important discoveries. The benefit of all this strenuous and costly effort will be acknowledged, perhaps not immediately, but in the years to come.

Synthetic Oil

Another significant development in this onward march is the proposal to set up a synthetic oil plant in India. Interest in the manufacture of oil from coal is international. The calamitous effect of having petroleum supplies cut off, or severely restricted, in the event of war has in many countries encouraged the adoption of various protective devices.

The possibility of producing synthetic oil from coal has been under examination for some time by the Government of India. Successful attempts in this direction have been made in Germany, Japan and the U.S.A. Experts consulted were of the opinion that the kind of coal

from which this oil could be made was available in plenty in India. Petrol from coal, it was realized, would be more expensive than natural petrol, but to think of production only in technical and economic terms, it was felt, would be dangerous. Defence considerations were also involved.

The present situation in India is too complex to analyse briefly, but the principal factors governing it are fairly clear. In May 1954, a Committee was set up to advise Government in regard to the desirability of setting up a plant for synthetic oil, taking into consideration all relevant factors, including the report already available and the latest technical developments. The committee submitted its report in September 1954 recommending the setting up of a plant capable of producing per annum 3,00,000 tons of fuel made up of 85,000 tons of aviation spirit and 2,15,000 tons of motor spirit, diesel oil and lubricants: the cost was estimated at Rs 55 crores. As a first step, the committee suggested obtaining project reports from firms of international repute. Government accepted the recommendations in principle. It was decided that a project report should be prepared before decisions on capital investment and other matters could be taken. Since the last project reports were received there has been a great deal of progress in the development of techniques in the United States and Germany. Fresh project reports covering the latest developments have been called for. Meanwhile, sites in low-grade coal areas in West Bengal, Madhya Pradesh, Hyderabad and Vindhya Pradesh are under examination and the Indian Fuel Research Institute, Jealgora, is building a pilot plant.

Progress with the project has been relatively slow, primarily because of the heavy investment required. It is hoped that by-product manufacture for the rapidly growing organic chemical industry will help to amortize the amount.

Prospects

We can look forward with confidence to a healthy petroleum industry which in its products and processes keeps up with the striking technical advances which are taking place in this age of nuclear energy. The broad picture is that of an industry expanding at unprecedented speed with what is almost a chain of refineries. The industry is destined to move steadily on to new levels of production; a gratifying development fully in conformity with an expanding economy.

CHAPTER X

THE CHEMICALS INDUSTRY

CHEMICAL industries have been defined by the Chemical Industries Committee of the International Labour Office (April 1950) as 'industries entirely or mainly devoted to the manufacture of chemical products' and 'all branches of industry to the extent that they are entirely or mainly devoted to the manufacture of chemical products even in cases where the industries of which they are branches are not themselves entirely or mainly devoted to the manufacture of such products'.

Dividing chemicals into 'heavy' and 'fine' is difficult, for the border line is indistinct. In general, known chemicals which serve as basic material for the production of other substances are 'heavy' and those which are consumed directly are 'fine'.

The chemicals industry in India, as perhaps quite a few others, has grown up largely at haphazard. Behind it there was no plan. This is small wonder, for planning is a recent phenomenon. It might have helped greatly had producing units been located at places selected with particular reference to availability of raw materials, labour, fuel and electric energy, access to transport, and proximity to markets. True, it would be idle to expect a place to have all the advantages. It seems that there are only about twenty places in the world ideally suited for a chemical industry and not one of them is in India. Yet the best out of the available might have been chosen. Where suitable units exist they are at best happy accidents. Re-location now would be painfully reminiscent of Tughlaq's historic attempt at changing the capital.

There were 191 registered factories in India in 1947-8. By 1951, the number had increased to 264.

The industry is represented on the Central Advisory Council of Industries; the Development Committees for Heavy Chemicals, Tar Products, Fine Chemicals and Pharmaceuticals, and Electro-chemicals; and on the Target Committees for Chemicals constituted by the Government.

Old methods of production are gradually being replaced by electrolytic and electrothermal processes. Wider and more rapid adoption of these processes would depend on availability of electric power at rates which will permit of economic production. Manufacture of caustic soda by the electrolytic method has made available large quantities of chlorine. And in the synthetic chemicals industry these new processes have proved invaluable.

But to attribute increases in production solely to these new methods would be incorrect. On balance it would, however, appear that increased production in recent years has not been due so much to improvement in methods of production as to establishment of new, and expansion of existing, units. (Productive capital employed rose from Rs 11.9 crores in 1946 to Rs 15.7 crores in 1947 and there has since been a further substantial rise.) Equally incorrect would it be to assume from this that one is less important than the other. Production, to be significant, requires a concurrent approach. In the choice of the methods of manufacture a number of problems are bound to arise. Only a careful study of the comparative merits of the various possible alternative processes could minimize the possibility of error.

A large variety of materials is consumed in the process of production ; but compared to the wide range of commodities produced, materials consumed are not many.

About 80 per cent of the coal supplied to the industry is of high grade. The balance is of Grade II. The industry complained of short supply in 1948-9. It is clear now that the shortage was not due to any reduction in allotment but to an increase in demand, new lines of manufacture having been developed. The situation has since improved. Supply of cement, iron and steel is arranged by the Development Officer, Chemicals, Ministry of Commerce and Industry.

In the case of some chemical products, output exceeds domestic demand ; in others, demand and supply are balanced ; in a third group, production is in an experimental stage and output small, but new processes are being evolved ; in a fourth, there is no home production yet. Each section of the industry has its own problems.

Fine chemicals are handicapped by their dependence on the heavy chemicals industry for raw materials ; and these have not always been available in adequate quantities. Further, production of fine chemicals calls for great technical skill. A high standard of purity has to be maintained. Hence production in present conditions can only be small ; yet it has been enough to meet some of the needs of the pharmaceutical industry, while in consonance with the recommendations of the Fine Chemicals Panel, manufacture of pharmaceuticals from imported raw materials has proceeded simultaneously.

Heavy Chemicals

Sulphur

As a fundamental raw material, sulphur occupies a notable place in industry. Indeed, with the exception of coal, there is perhaps none more important. This importance is derived not so much from its use as such but from the wide range of industrial utility which its secondary

products offer. Fertilizers, alcohol distillation, textiles, leather, petroleum refining, ferrous and non-ferrous metals, sugar and paints are but a few of the many industries that it serves.

India has no known sulphur deposits of any consequence. Almost all the country's requirements are imported. And till recently supplies from abroad have been difficult to obtain, for world consumption had increased without a balancing increase in output. The U.S.A., the primary supplier of all consuming countries, exercised strict control over exports of crude sulphur.

Against estimated minimum requirements of 62,000 tons, India was allotted in 1951 only 44,000 tons. The shortage continued in the early part of 1952 and affected production of sulphuric acid. It was not till 1 March 1953 that the supply position was satisfactory enough to warrant discontinuance of the system of allocation by the International Materials Conference.

The danger of a renewed shortage has led to efforts to find within the country other possible sources of sulphur. Sulphur is obtained principally from pyrites, gypsum, waste sulphurous gases from metallurgical operations, sodium sulphate, magnesium sulphate and sulphur present in coals and refinery waste gases. The deposits of pyrites recently discovered in the Shahabad district of Bihar, apart from being a valuable addition to reserves, are of a grade which suggests that supplies of sulphur obtained may be substantial. Chemical industries in Europe depend primarily on pyrites for sulphur.

In collaboration with the Geological Survey of India, the National Metallurgical Laboratory, Jamshedpur, is engaged in evolving a technique for the extraction of sulphur from the low-grade pyrites of Chitaldrug. The reserves of gypsum in the more important deposits in India amount to over 74 million tons. Gypsum is also known to occur in Uttar Pradesh, Kashmir, Simla Hills, Central India, Western India and Bhutan. Some of these deposits are either not fully explored or too distant from existing means of communication to be of present commercial utility, while some others are too small to be of commercial importance.

According to the Fuel Research Institute, Jealgora, a substantial contribution to the sulphur requirement of India can be made by the recovery of pyrites from Madhya Pradesh coals and their beneficiation. Investigations into their washability characteristics are reported to have shown that 'practically 80 per cent of the pyritic sulphur could be separated'. Another important development is the attempt to utilize the sulphurous gases from copper production factories. These gases, capable of yielding nearly 20 tons of sulphur per day, have been going waste for several years. In this task of recovery the assistance of the American

expert, secured under the Point Four Programme, has been of great help.

That the supply is now satisfactory is no guarantee that it will continue to be so. Economy in consumption is essential within the country. Progress in this direction has not been particularly rapid. For a quickening of pace much closer co-ordination between the producing and consuming industries than has so far been achieved seems fundamental.

Principal among the numerous derivatives of sulphur is sulphuric acid, whose industrial uses are manifold.

Prior to World War II, there were in India about 23 units manufacturing sulphuric acid. The industry developed during the war. An increase in requirements and a fall in imports stimulated this, as other industries. By 1946 the number of units had increased to 36, some producing the acid mostly for their own consumption. There were 43 units in 1953.

Production has been largely from imported sulphur and the U.S.A. has been the main supplier. Imports figures are : 1948-9, 38,331.85 tons ; 1949-50, 40,955.35 tons ; 1950-1, 55,326.5 tons ; 1951-2, 37,280.9 tons and 1952-3, 73,941 tons. Installed capacity increased from 57,000 tons in 1937-8 to 65,000 tons in 1943-4 and to 1,00,000 tons in 1946-7. Present installed capacity is estimated at 1,88,420 tons. Availability of sulphur—the basic raw material—has set the limit to production. From 26,755 tons in 1937-8 production increased to 59,000 tons in 1944-5 and to 99,458 tons in 1949. Production in 1950 amounted to 1,02,480 tons and in 1953, to about 1,04,074 tons.

In 1946 consumption was about 55,760 tons. *Per capita* consumption in 1948 was 0.45 lb. The largest consumers were the fertilizer, other chemicals and metals, and textile industries. Present annual consumption is estimated at 1,00,000 tons. The demand from allied heavy and fine chemicals industries is about half the total and seems to be going up. Most industries using sulphuric acid are now well-established and will need abundant and continuous supplies.

Imports of sulphuric acid have been relatively small. In 1937-8 they were about 132 tons. During the war, foreign supplies shrank to about four tons per annum ; they have not risen appreciably since. In 1949-50 they amounted to about 23 tons ; in 1950-1 to about 6 tons and in 1951-2 to only about 3 tons. The high cost of transport and difficulties of packing have discouraged imports and have had virtually a protective effect on Indian products.

The demand for sulphuric acid was expected to increase to about 2,00,000 tons by 1955-6. Alongside the search for indigenous sources, there have been attempts to get industries to readjust themselves so far as possible to alternative raw materials available.

Exports seem neither possible nor advisable for some years yet as production just about meets the country's requirements.

Details of the development planned for the industry are given below :

	1950-1	1955-6
Number of units	43	51
Annual rated capacity		
(tons of 100 per cent acid)	1,50,410	2,20,791
Actual production		
(tons of 100 per cent acid)	99,153	2,00,000

Aluminium Sulphate

Aluminium sulphate is used mainly in the paper and textile industries and for water purification. The tanning, dyeing and textile industries use alums.

Raw materials required are bauxite and sulphuric acid. Bauxite resources are adequate. Sulphate of aluminium and alums are being produced mostly by sulphuric acid manufacturers.

Production of sulphate of alumina in 1946 was about 16,000 tons, installed capacity being 17,000 tons. There are now 19 producing units. The annual installed capacity is assessed at 39,000 tons, and production in tons during the years 1949-51 has been: 1949, 15,408; 1950, 18,923; and 1951, 19,350. The present rate of production is said to be high enough to meet the country's requirements which are estimated at about 18,000 tons per annum. The Panel on Heavy Chemicals (1946) recommended a five-year production target of 38,000 tons.

Possibilities of exports are under consideration.

Between 1937 and 1941 imports were about 2,000 tons per year. They fell to about 500 tons in 1941-2 and rose again to about 4,500 tons in 1944-5. Imports in recent years have been : 1948-9, 18,467 cwt. ; 1949-50, 7,589 cwt. ; 1950-1, 52,328 cwt. ; 1951-2, 2,135 cwt. and 1952-3, 4,615 cwt.

Magnesium Sulphate (Epsom Salt)

The main uses are in medicine and in the paper, textile, leather, dye-stuffs, paint and varnishes industries.

There are now about 25 manufacturing establishments in India, mostly on the west coast. Production in 1950 amounted to 3,832 tons. Production during the year 1951 is put at about 3,520 tons.

The following table summarizes capacity and production in the last few years:

Manufacture	Year	Capacity (Tons)	Production (Tons)
1. Acid process	1952	5,490	2,417
	1953	6,000	2,584
	1954	6,000	Not available
2. From bitters	1952	1,050	513
	1953	1,050	623
	1954	1,500	Not available
Total	1952	6,540	2,930
	1953	7,050	3,207
	1954	7,500	Not available

(Source : Indian Chemical Manufacturers' Association)

New processes of manufacture are being evolved. It is believed that indigenous production can be increased sufficiently to meet all the country's needs.

Imports before the war came mostly from Germany. Since World War II imports have been : 1946-7, 30.35 tons ; 1947-8, 53.10 tons ; 1948-9, 0.75 ton ; 1949-50, 1.9 tons ; 1950-1, 0.5 ton ; 1951-2, 1.15 tons and 1952-3, 0.9 ton.

Iron Sulphate

The paint and dyestuffs industries are the main users. Raw materials required are scrap iron and sulphuric acid, both available in India. Pre-war annual production was about 500 tons. There are now 12 producing units with a total annual installed capacity of 2,238 tons. Production in tons during the years 1949-51 amounted to : 1949, 670 ; 1950, 599 and 1951, 612. The present rate of production is estimated at about 600 tons per annum, about enough to meet domestic requirements.

Copper Sulphate (Blue Vitriol)

Copper sulphate is used principally as a fungicide and insecticide in coffee, tea and rubber plantations. Other uses include calico printing and the preservation of wood, bags, etc.

Manufacture is almost entirely from copper scrap. India being deficient in copper, supply of copper scrap to the industry has been inadequate. And so have supplies of sulphuric acid.

There are now 11 producing units. Production (in tons) in recent years has been : 1949, 450 ; 1950, 437 ; 1951, 505 ; 1952, 338 and

1953, 474. The present rate of production is estimated at about 500 tons, and requirements at 1,700 tons per annum.

Imports (in tons) during recent years have been : 1946-7, 801.65 ; 1947-8, 1,309.70 ; 1948-9, 1,276.45 ; 1949-50, 1,111.35 ; 1950-1, 1,302.9 ; 1951-2, 2,111.1 and 1952-3, 832.

The manufacture of copper sulphate from imported copper pyrites may not be economical, and the stuff is not easy to obtain from abroad (principally from Spain). Copper sulphate imported for agricultural purposes is exempt from duty.

Indian manufacturers are seeking increased facilities.

Sodium Sulphate (Glauber's Salt)

Main users are the textile, paper, glass and tanning industries. The salt is used also as medicine.

There are deposits in Bihar and Jodhpur.

Average annual production pre-war (1935-40) was 1,000 tons. By 1943-4 it had increased to 2,000 tons, and since then there has been no great increase. Indeed, the current rate of production is about that amount.

Annual imports during 1935-40 were on an average 1,200 tons. As home production increased, imports fell. Figures for recent years are : 1945-6, 24.05 tons ; 1946-7, 39.00 tons ; 1947-8, 8.30 tons ; 1948-9, 45.75 tons ; 1949-50, 17.1 tons ; 1950-1, 0.05 ton ; 1951-2, 9.6 tons and 1952-3, 2.25 tons. It seems that soon all domestic needs, estimated at about 4,000 tons per annum, will be met from Indian production.

Sodium Sulphide

Sodium sulphide is used mainly as a developer of sulphur dyes, as a depilatory in the tanning industry, and as a reducing agent for other chemicals ; also in the textile industry and in photography.

Prior to World War II there was little or no manufacture in India. Almost all requirements were met by imports which were between 2,000 and 3,000 tons per annum. Manufacture in India developed during the war. By 1947 installed capacity had increased sufficiently to meet the country's total demand. The State Government plant in Jodhpur—installed capacity 3,000 tons per annum—is the largest. There are now in all 13 producing units with a total annual installed capacity of about 7,900 tons. Production (in tons) during the years 1949-51 was as follows : 1949, 533 ; 1950, 790 ; and 1951, 1,935. The present rate of production is estimated at about 2,000 tons per annum.

Imports during recent years have been : 1945-6, 3,458.45 tons ;

1946-7, 1,500.50 tons ; 1947-8, 1,018.90 tons ; 1948-9, 3,456.60 tons ; 1949-50, 1,032.45 tons ; 1950-1, 1,011.6 tons ; 1951-2, 2,239.6 tons and 1952-3, 633.4 tons. They have come mostly from Britain, France, the Netherlands, the U.S.A. and Belgium. In view of adequate installed capacity and a recent increase in home production, imports are being regulated.

Annual consumption pre-war was about 2,000 tons. At present it is estimated at about 3,000 tons.

Sodium Sulphite and Sodium Bisulphite

These are used mainly in photographic developing processes and to a small extent for other purposes.

In 1946 installed capacity amounted to about 300 tons of each per annum. The Panel on Fine Chemicals (1946) recommended a 10-year target of 300 tons for sodium sulphite and 800 tons for sodium bisulphite per annum. Annual imports pre-war averaged 100 tons of each.

The statement below summarizes the progress of the industry in recent years :

	Year	Number of Units	Annual installed capacity (Tons)	Production (Tons)
Sodium Sulphite	1949	2	420	74
	1950	2	420	163
	1951	2	420	204
	1952	2	370	220
	1953	3	520	260
Sodium Bisulphite	1949	3	735	117
	1950	3	735	270
	1951	3	735	271
	1952	2	600	310
	1953	2	600	325

The present capacity is considered adequate for domestic needs.

Sodium Thiosulphite (Hypo)

The main use is in photography. Next in importance as a user is the pharmaceuticals industry.

There was no manufacture in India before World War II. Requirements were met by imports which averaged 500 tons per annum. Production began during the war. Installed capacity in 1946 was estimated at 900 tons per annum, and annual consumption at about

600 tons. Since then, both have increased. Production during the years 1950-2 has been estimated (in tons) at : 1950, 478 ; 1951, 610 ; and 1952, 630. Present production capacity is about 1,000 tons and the rate of production about 800 tons per annum. The Panel on Fine Chemicals (1946) recommended a 10-year production target of 1,000 tons per annum. Statistics of total present consumption are not available, but it is believed to be well below production capacity.

Imports during recent years have been : 1945-6, 158.75 tons ; 1946-7, 7.8 tons ; 1947-8, 6.55 tons ; 1948-9, 202 tons ; 1949-50, 225 tons ; 1950-1, 16 tons ; 1951-2, 13 tons and 1952-3, 10.85 tons.

Sodium Hydrosulphite (Hydros)

'Hydros' is used chiefly in the textile and sugar industries. Raw materials required are zinc and sulphur dioxide, both of which are scarce in India.

Production is negligible ; and is at the experimental stage. Requirements are met by imports which average 2,500 tons per annum.

The Heavy Chemicals Panel recommended that manufacture of this chemical should be taken up and that the Council of Scientific and Industrial Research should continue investigations of alternative processes of manufacture, utilizing Indian raw materials. The target is 3,000 tons per annum.

Alkali Industries

Common Salt (Sodium Chloride)

Common salt is used in India chiefly as a food. Its use as an industrial raw material in, say, the manufacture of ammonia, soda, glass, soap, textiles, paper, ceramics and enamels is comparatively small ; and as a preservative of meat, fish, dairy products, etc., undeveloped.

The main sources of supply are rock salt deposits and sea water. Manufacture is mostly along the Indian sea coast, particularly the Coromandel.

Production has been steadily on the increase. From about 3,83,33,000 maunds in 1938, it grew to nearly 4,45,00,000 maunds in 1946. Figures for the years 1947-51 are : 1947, 5,16,00,000 mds ; 1948, 6,35,28,000 mds ; 1949, 5,56,20,000 mds ; 1950, 7,13,16,000 mds ; and 1951, 7,43,76,000 mds.

The statement below summarizes the situation during the years 1953-4 and includes a forecast of production in 1955 ;

Producing State	Total number of salt factories (Group of Works)	Total number of licensees in 1954		Total acreage under production	Salt production in lakh maunds		Percentage of increase or decrease	Forecast of salt production in 1955
		Government	Private		1953	1954		
Rajasthan	3	3	—	7,345	86.8	85.3	—2%	68.8
Bombay	22	2	879	18,806	239.9	216.2	—10%	232.2
Saurashtra	30	—	30	18,369	217.5	164.2	—24%	205.4
Kutch	4	—	4	7,802	37.2	43.8	—18%	54.7
Madras	36	—	1,573	8,265	132.7	106.8	—19%	139.9
Andhra	27	—	1,338	8,278	61.0	44.7	—27%	60.8
Travancore-Cochin	11	—	204	905	16.6	13.6	—18%	17.0
Orissa	6	—	37	3,270	13.9	7.1	—50%	13.9
West Bengal	4	—	4	385	1.2	1.2	—	1.9
Himachal Pradesh	1	1	—	1,600Δ	1.6	1.1	—31%	1.5
Unlicensed production	—	—	—	sq. yds. 4,405 (estimated)	52.5	57.7	—9%	50.0
TOTAL	144	6	4,069	77,830	860.9	741.7	—13.8%	846.1

Δ Not included in the total.

(Source: Ministry of Production)

During 1952, production in the private sector amounted to about 620 lakh maunds, approximately 80 per cent of the total output in that year. The years 1951-3 are memorable for diverse reasons. In 1951, self-sufficiency was achieved; in 1952 exports were possible and commenced; and in 1953 the Planning Commission target for 1955-6 (837 lakh maunds) was exceeded.

There is considerable variation in the quality of salt produced. This is attributed to diversity of sources and differing methods of manufacture and storage. Sea salt is regarded as inferior to (less pure than) rock salt.

There has been a rapid increase in unlicensed production by small manufacturers. For instance, in 1952 it was about 60 per cent over that in the previous year. The quality of this output is far from satisfactory. Indeed, it has created a problem. Owing to the inadequacy of inspection staff, quality has not been possible. Were this allowed to continue, it might ultimately undermine the whole structure of the industry.

In addition to the existing Model Farms and Salt Research Station at Wadala in Bombay, test laboratories at Sambhar, Tondiarpet and Tuticorin in Madras and the Central Salt Research Station at Bhavnagar in Saurashtra, a test laboratory has been established at Humma in Orissa. The Government has under consideration proposals for the setting up of more laboratories in Madras, Kakinada, Travancore, Kharaghoda and Mandi and the establishment of model farms at Levingipuram and Sammanjeri (Madras), Samadi (Orissa) and in Travancore.

In 1952, a beginning was made with the Mandi development scheme. Core drilling was commenced in Mandi rock salt mines to ascertain the extent of salt deposits. Latterly, as a result of certain technical difficulties which have arisen, the scheme has had to be revised.

In collaboration with the Railway Board, a zonal scheme has been introduced and is in operation for the supply of salt to consuming areas. Reporting to the Government in July 1953, the Commodity Control Committee covered *inter alia* three aspects: (i) reduction of the stocks held under the Salt (Reserve Stocks) Order, 1950; (ii) continuance of the zonal scheme of distribution until the transport position improved; and (iii) review of the nominee system in certain States for the indenting of salt. The Government has approved of the continuance of the zonal scheme; the other two recommendations are under examination.

In pursuance of a decision that salt should not be treated as a source of revenue, the salt duty of Rs 1/9/- per maund was abolished from 1 April 1947. Simultaneously however a cess at the rate of As. 3/6 per maund on salt produced in Government salt factories and at As. 2 per maund on the output of private licensed factories to meet the expenses incurred on the salt organization maintained by the Central Government and on the measures taken in connexion with the manufacture, supply and distribution of salt was imposed.

Consumption in India in 1946 was computed at about 2.25 million tons. *Per capita*, it worked out at 14 lb. per annum.

The Indian Standards Institution has prescribed specifications for salt. For edible salt the minimum standard for 1953 was fixed at 93.5 to 94 per cent sodium chloride; an increase from 92.5 to 93 per cent had been fixed for 1952.

On the basis of *per capita* consumption, the country's total requirements in 1952 were 717 lakh maunds and the estimate for 1953 was 725 lakh maunds.

Exports in recent years have been :

Year	(Figures in lakh maunds)						Total
	To Japan (by sea)	To East Pakistan (by land and river)	To Nepal (by land)	To East Africa (by sea)	To Maldives, Malaya etc. (by sea)		
1952	...	67.37	3.66	8.39	—	0.06	79.48
1953	...	68.14	2.50	9.14	0.11	0.15	80.04
1954	...	53.82(a)	—	7.00	0.35	0.15	61.32

(a) indicates 14,000 maunds exported to Okinawa — U.S.A.-occupied area.

(Source: Ministry of Production)

There have been exports also to the Philippines, New Zealand and East Africa. Possible expansion of the market in these countries is under study.

Lime (Calcium Oxide)

Among alkalis, lime is perhaps the most important to industry. It is used in glasswork, metallurgy, paper manufacture, sugar refining, tanning, cement production, and in agriculture. Water purification is another of its many uses. The chemicals industry itself uses lime. Annual requirements are estimated at half a million tons per annum as processing material for the production of a number of auxiliary chemicals.

Reserves of limestone in India are considerable and widely distributed. Recently there were reports that further deposits covering an area of nearly 25 sq. miles had been discovered at Chitor in Rajasthan.

Reliable statistics of production are not readily available. By area, average annual production (in tons) is reported to be : Bihar, 6,80,000 ; Madras, 2,00,000 ; other areas, 10,00,000. Production is enough to meet all internal requirements. Lime produced in soda ash plants is consumed in the plant. Manufacture is still mostly in country kilns. The Panel on Heavy Chemicals (1946) recommended installation of modern lime kilns in several parts of the country so that lime of guaranteed quality could be supplied to the chemical industries and to sugar factories. Investigation of the burning qualities of different samples of limestone in collaboration with the Geological Survey of India was suggested. The high-quality lime required by many industries is not available in India.

Sodium Carbonate (Soda Ash)

Soda ash is consumed in large quantities by the glass, soap, ceramics, caustic soda, paper, rubber, metals, bichromates, petroleum refining, pharmaceutical, textile and chemical industries.

Raw materials required are sodium chloride, limestone, coke, coal and ammonia—all available in India.

Manufacture involves heavy capital outlay. The industry is largely a wartime development. Progress has since been sustained. Production in 1941 amounted to 11,614 tons. There are now two plants in operation : one at Mithapur and the other at Dhrangadhra. The location of existing units is not all that could be desired. For economic operation, propinquity to salt, limestone and coal is essential. Such sites are rare. But that should be no reason for inaction. Surveys of promising areas have to be initiated. It has been lately reported that the Government is investigating the possibilities of setting up plant for

the manufacture of both heavy and light soda ash in various parts of the country. Present total installed capacity is estimated at about 90,000 tons. Production (in tons) during recent years has been : 1951, 47,532; 1952, 44,328; 1953, 56,868; and 1954, 48,288. Yet it is hardly enough to meet even half of the country's present requirements. With the expansion of industries using this chemical, consumption has increased considerably and is at present estimated at about 1,20,600 tons. It was expected to go up to 1,55,000 tons by 1955-6. According to the Tariff Commission, consumption will increase to nearly 1.4 lakh tons by 1958. The expansion of existing units contemplated promises an annual output of 1.76 lakh tons by 1958. Imports will then not be necessary.

The Indian product is more costly than the imported. Abolition of the salt cess and lower freight rates would help to reduce cost of production. Equally helpful would be foreign technical advice in manufacture.

Imports (in '000 tons) during recent years have been : 1945-6, 78 ; 1946-7, 58 ; 1947-8, 68 ; 1948-9, 163 ; 1949-50, 12 ; 1950-1, 30 ; 1951-2, 80 and 1952-3, 81.59.

Tariff protection continues to the end of 1958; and the duties are now being levied at specific rates instead of *ad valorem* rates.

In January 1951, the Government of India brought the industry under the purview of the Supply and Prices of Goods Act, 1950, and fixed the minimum prices at which the several varieties of soda ash may be sold. Since then, these prices have been revised.

The Indian Standards Institution has fixed tentative standards for soda ash (technical). It is hoped that the specifications issued will help manufacturers to improve quality. There is every hope that the country will soon achieve self-sufficiency in this important basic chemical.

Sodium Bicarbonate

Sodium bicarbonate is used chiefly in the preparation of medicine and pharmaceuticals ; also in the manufacture of baking powders and fire extinguishers.

Most soda ash manufacturers produce sodium bicarbonate. The Indian product is of good quality but rather expensive. Production in 1950 amounted to 431 tons ; in 1951, to 635 tons ; and in 1952 and 1953, to 2,000 tons each year—merely a small fraction of the country's requirements, which are estimated at about 6,600 tons per annum.

Imports (in cwt.) during recent years have been : 1949-50, 80,455 ; 1950-1, 35,953 ; 1951-2, 1,93,537 and 1952-3, 61,210. With the recent increases in production, larger quantities of soda ash should be available for the manufacture of sodium bicarbonate.

Sodium Silicate

Sodium silicate is used mainly in the manufacture of soap, paper, textiles, silk, in the lining of casks and in the preparation of mortar for house construction.

Many small firms manufacture this chemical. No reliable statistics are available of their number or of the extent of their operations. An estimate puts production at about 5,000 tons a year.

Import figures are interesting. In 1937-8 they were 1,607.15 tons, in 1942-3 457.35 tons and in 1944-5 142.65 tons. In 1950-1 they amounted to only 20 tons, in 1951-2 to about 24 tons and in 1952-3, to about 7.5 tons. The drop is some indication of the progress in home production. The industry depends largely on adequate supplies of soda ash at a low price.

Caustic Soda

Caustic soda is one of the most important heavy chemicals and essential for many industries. It is used in the manufacture of rayon, soap, textiles, paper, other chemicals, rubber, dyestuffs, metals, ceramics, toilet articles, foods and disinfectants.

Before World War II there was little or no manufacture in India and all requirements were imported. Manufacture in India began during the war, but could not make much headway as plant was difficult to procure from abroad. With the end of the war, supply improved. Installed capacity increased from 12,000 tons in 1946 to about 18,000 tons in 1950. The installed capacity of the existing 12 producing units is estimated at 39,680 tons. The Panel on Heavy Chemicals recommended location of new units in Bombay, Porbander, Mandi, Madras, Mysore, Hyderabad and Bihar. The more important factories are in Calcutta, Mettur, Mithapur, Delhi and Ahmedabad. Some paper mills produce their own requirements. New units are under construction and some factories are in the process of expansion.

Production (in tons) during recent years has been : 1951, 14,722 ; 1952, 17,058 ; 1953, 21,760. It has kept pace with the increase in capacity. But for the numerous problems which have beset manufacture, the record might have been much brighter. The cost of production has been high ; so high indeed as to necessitate tariff protection. For this, several factors have been responsible. Chiefly they are the cess on, and the low purity of, industrial salt ; the comparatively high cost of power ; and the low offtake of the by-product, chlorine.

Time and again the industry has protested against the levy of a cess on salt—a basic raw material. Removal of the cess, it is pointed out, would reduce the cost of production by Rs 7 to Rs 13 per ton of caustic

soda or soda ash. 'The relief sought', it is added, 'would amount to only 5 per cent of the total revenue from the cess and should not be any great sacrifice to the exchequer, particularly when it is directed to give a stimulus to a basic industry.' The Government attitude has been that the appropriate authority to consider the question was the Tariff Commission. Latterly, however, there have been signs of relenting. A reconsideration of the plea in all its aspects has been promised. In the case of soda ash, the Government did not consider it necessary to exempt the salt used in manufacture from the cess as the incidence was 'so small that a total remission was unlikely to benefit the consumers . . . to any appreciable extent'. Consumption of chlorine in the country is still very low; only about nine to ten thousand tons annually.

In the circumstances, caution seems essential in expanding existing units or establishing electrolytic plants. Clearly, provision will need to be made first for larger utilization of chlorine. The industry was working to the following programme of development :

	1950-1	1955-6
Number of factories	7	9
Annual rated capacity (tons)	18,725	37,125
Production (tons)	11,375	33,000

(This is exclusive of the units attached to paper mills in which the caustic soda and chlorine are directly consumed.)

The main problem facing this industry for some time has been the disposal of chlorine produced. It is surplus to requirements. Hence most plants have had to work only up to 60 per cent capacity. The situation contrasts singularly—indeed strangely—with that elsewhere. For instance, in the U.S.A. all chlorine produced is consumed and caustic soda production is surplus to requirements.

The manufacture of D.D.T., B.H.C., ammonium chloride and dicalcium phosphate—the last two by using hydrochloric acid—are some of the important methods by which the offtake of chlorine could be stepped up. A factory has been set up in Delhi for the manufacture of 700 tons of D.D.T. annually for use by public health authorities in India. In August 1953 it was reported that the National Chemical Laboratory, Poona, had 'successfully completed a pilot plant for the manufacture of dicalcium phosphate from Trichinopoly phosphatic nodules employing hydrochloric acid'. Apart from the utilization of chlorine, this should have the advantage of adding to the country's stock of fertilizers and minimizing dependence on imported sulphur. Dicalcium phosphate is reputed to be a better fertilizer for acidic soils than superphosphates. Income from the sale of chlorine may have a salutary effect on both the production and price of caustic soda.

In spite of recent increases, production of caustic soda has not been able to meet the total internal demand. The total consumption in 1946 was estimated at 34,000 tons. By 1948, it had increased to 60,000 tons. Present consumption is estimated at 63,500 tons. On the basis of the expansion programmes formulated for alkali-consuming industries, the demand for caustic soda was expected to increase to 87,000 tons by 1955-6. With this, in spite of expansion, the caustic soda industry cannot keep pace. Clearly, imports will continue to be necessary.

Average imports pre-war were about 29,000 tons and during the war about 34,000 tons per annum. Imports (in tons) during recent years have been : 1945-6, 37,908 ; 1946-7, 29,890 ; 1947-8, 21,231 ; 1948-9, 91,589 ; 1949-50, 12,989 ; 1950-1, 22,067 ; 1951-2, 61,849 and 1952-3, 25,552.

The Indian Standards Institution recently prescribed tentative standards for caustic soda (technical). Owing to the industry's difficulties, requirements have been relaxed wherever this could be done without detriment to the interests of consumer industries.

Caustic Potash

Production in India is negligible.

The Heavy Chemicals Panel recommended that the plant to be set up in Bombay should have Government's assistance and that the industry should be protected without penalizing consumer industries. used also in the manufacture of explosives and fireworks.

Potassium Chlorate

The match industry is the largest consumer. The chemical is used also in the manufacture of explosives and fireworks.

Production in 1950 amounted to 1,800 tons and in 1951, to 1,593 tons. The present rate of production is estimated at about 2,000 tons per year. The largest producers are the Western India Match Co., Bombay.

An increase in production is possible and necessary. Two of the important raw materials required (e.g. lime and chlorine) are available in India in sufficient quantities. With the expansion of the match industry (which consumed about 1,800 tons in 1948-9) and the increased manufacture of explosives—commercial and military—consumption will increase. The present rate of consumption is estimated at 2,400 tons per year. The Heavy Chemicals Panel recommended installation of a plant of 1,000-1,500 tons capacity. The quality of the product needs to be improved. It is said to be only 70 per cent pure.

Annual consumption pre-war was about 2,000 tons, much of which

was imported. During the war, foreign supplies were hard to obtain. Post-war imports have been : 1945-6, 185.50 tons ; 1946-7, 66.65 tons ; 1947-8, 488.60 tons ; 1948-9, 1,080.05 tons ; 1949-50, 264.8 tons ; 1950-1, 673.7 tons ; 1951-2, 1,411.85 tons and 1952-3, 914.7 tons.

Chlorine

Large quantities are used in paper and textile manufacture, for water purification and in the preparation of insecticides (e.g. D.D.T.). It is also a processing material for the production of other chemicals.

There are now seven units in operation.

Installed capacity has been gradually on the increase. It was 13,080 tons in 1951. Present capacity is estimated at 17,444 tons. Production (in tons) during recent years has been : 1946, 1,500 ; 1947, 1,706 ; 1948, 1,800 ; 1949, 2,649 ; 1950, 3,970 ; 1951, 5,354 ; 1952, 6,239 and 1953, 9,286. Proper storage is a problem. Low offtake (about 4,000 tons per annum) seems to be chiefly responsible for production below capacity.

Bleaching Powder

Bleaching powder is used in paper manufacture, surgical dressings, textiles and as a disinfectant.

There are three units in operation. Present installed capacity in India is estimated at about 7,800 tons per year. Production during recent years has been : 1951, 3,583 tons ; 1952, 792 tons ; 1953, 1,929 tons. The steep decline in output in 1952 is attributable to excessive imports and the rise in 1953 to the revision of import policy. The present consumption is estimated at about 15,000 tons per year. The balance of requirements is imported.

Imports during recent years have been : 1945-6, 7,948.95 tons ; 1946-7, 7,316.40 tons ; 1947-8, 8,367.20 tons ; 1948-9, 11,520.50 tons ; 1949-50, 5,513.2 tons ; 1950-1, 5,633.1 tons ; 1951-2, 8,810 tons and 1952-3, 2,748.9 tons. Paper mills, textile mills, manufacture of other chemicals, and public health purposes account for a substantial portion of the total consumption. Present total consumption is estimated at about 15,000 tons.

There is scope for improvement in the quality of the indigenous product, the chlorine content of which is less than that of the imported material.

Hydrochloric Acid

Hydrochloric acid is used for various industrial purposes, and is the base for many auxiliary chemicals.

Most sulphuric acid manufacturers also produce hydrochloric acid. In 1938-9, production was about 7,200 cwt. By 1944-5 it had increased to 13,002 cwt. Output in more recent years was assessed at : 1951, 33,500 cwt. ; 1952, 40,000 cwt. ; and 1953, 50,000 cwt. Fears of overproduction have been expressed. These seem hardly justified, particularly in view of the continuing sulphur shortage. Annual consumption pre-war was about 8,000 cwt. Statistics of present consumption are not available, but it is believed to be much higher. Current industrial expansion postulates increased consumption and the process has only just begun. The Panel on Heavy Chemicals recommended that for any extra production required manufacture from hydrogen and chlorine must be adopted. This would eliminate the use of sulphuric acid manufactured from imported sulphur and provide a suitable outlet for some of the chlorine produced in the electrolytic alkali industry. Synthetic production is now being attempted in a few factories (e.g., Mettur, Mithapur, Delhi). Increasing quantities are being produced.

Cost of production varies considerably between factory and factory. This is largely due to the varying price of salt and the equally varying freight rates. With the increasing adoption of the synthetic process, the effect of the salt prices should become less significant. The second factor is less tractable. Telescopic rates seem almost sacrosanct. Freight on hydrochloric acid is higher than on sulphuric. Beyond a certain distance transport becomes uneconomical.

Imports have been negligible and are declining. Figures for recent years are : 1937-8, 45.05 tons ; 1940-1, 21.45 tons ; 1948-9, 4.50 tons ; 1949-50, 6 tons ; 1950-1, 7.5 tons ; 1951-2, 4.3 tons and 1952-3, 6.5 tons

Zinc Chloride

This chemical is used mainly in the textile industry as protection against mildew ; also in the manufacture of dry cells.

Manufacture in India has been attempted, but the results have not been too satisfactory, not from the technical but the commercial point of view. Local supplies of cheap zinc residues and the right operational equipment, e.g. synthetic resin, are needed. Importing them adds considerably to the cost of production. Yet, judging from the fall in imports during the last few years, it would seem that there has been some progress in indigenous production. Output in 1950 amounted to 426 tons ; and in subsequent years it has been estimated at : 1951, 300 tons ; 1952, 500 tons ; and 1953, 600 tons. Import figures are : 1937-8, 1,746.60 tons ; 1941-2, 1,955.35 tons ; 1945-6,

635.15 tons ; 1948-9, 832.10 tons ; 1949-50, 552.25 tons ; 1950-1, 442.25 tons ; 1951-2, 246 tons and 1952-3, 246.75 tons.

The present annual consumption is estimated at about 1,000 tons.

Magnesium Chloride

This is used chiefly in the textile industry for sizing. It is used also in refrigeration and in the manufacture of magnesium.

There are two methods of manufacture : one from bitterns and the other by the action of acid on magnesite. Production in India started during World War I, and has since so much increased that imports are no longer necessary. Output figures are : 1938, 5,074 tons ; 1942, 9,251 tons ; 1946, 6,098 tons ; 1948, 7,705 tons ; 1950, 4,011 tons. In more recent years, it has been estimated at : 1951, 3,639 tons ; 1952, 3,500 tons ; and 1953, 3,000 tons. Production has exceeded requirements by about 1,000 tons, which excess has been exported. The present rate of consumption is assessed at 2,500 tons per year.

Imports during recent years have been : 1937-8, 593.80 tons ; 1939-40, 349.40 tons ; 1948-9, 0.40 ton ; 1949-50, 0.9 ton ; 1950-1, nil ; 1951-2, 1 cwt. and 1952-3, 4 cwt.

The need for protection to this industry has been examined by the Tariff Board twice ; once in 1945 and again in 1948. Protective duties were recommended and were in force till recently. The industry is now well established and able to meet foreign competition without assistance from the State.

Assistance, however, in the form of the supply of containers to manufacturers would be welco

Calcium Chloride

Calcium chloride is used mainly as a refrigerant and as processing material in the chemicals industry.

Production in India started in 1941. Output in 1950 amounted to 1,345 tons ; and for subsequent years it has been estimated at : 1951, 960 tons ; 1952, 1,200 tons ; and 1953, 1,500 tons. The present requirements are about 1,500 tons per annum. It is believed that any possible increase in consumption could also be met, for the contemplated expansion of the soda ash industry would make larger quantities of calcium chloride available. Import figures are revealing : 1937-8, 910.30 tons ; 1940-1, 664.10 tons ; 1942-3, 361.15 tons ; 1945-6, 32.35 tons ; 1948-9, 228.55 tons ; 1949-50, 284.95 tons ; 1950-1, 44.6 tons ; 1951-2, 15.5 tons and 1952-3, 5 tons.

Potassium Chloride (Muriate of Potash)

The chief use of potassium chloride is as a fertilizer. Imports

formerly averaged 3,000 tons per annum. A few firms are now manufacturing small quantities from bitters and from *reh*¹ deposits.

The Heavy Chemicals Panel recommended that existing manufacture should be increased and the quality of the product improved. The Indian Standards Institution has prepared a standard for this commodity.

Barium Chloride

This chemical is used mostly in the tanning industry. Small quantities are manufactured in India. The Heavy Chemicals Panel recommended the manufacture of 1,000-1,500 tons per year in one of the alkali plants. This is considered too high a target. The present requirements are about 500 tons per annum.

Nitric Acid

Nitric acid is used chiefly in the manufacture of explosives, dyestuffs, other chemicals, fertilizers; in the processing of steel; and in the refining of gold, silver and copper.

Most sulphuric acid manufacturers also produce nitric acid. Manufacture of synthetic nitric acid by the oxidation of ammonia—a process widely adopted in other countries—has been proposed.

In 1938-9 about 11,763 cwt. of nitric acid were produced. Production increased considerably during the war to meet defence needs, and in 1946 amounted to about 26,000 cwt. Production in 1950 amounted to 30,800 cwt. The present annual production, estimated at about 55,000 cwt., is enough for all home requirements, which are estimated at about 30,000 cwt. per year. The supply will be augmented when the synthetic ammonia plant at Sindri goes into production. The target is 80,000 cwt. Imports fell from 120.35 tons in 1937-8 to 4 tons in 1952-3.

Civilian consumption in India was about 15,000 cwt. in 1946. (Army demands were met by ordnance factories.) Consumption has since increased and seems likely to grow further. Expansion of the dyestuffs and fertilizer industries is expected and, when this materializes, there should be a substantial increase in the demand for nitric acid. The Heavy Chemicals Panel recommended that any surplus capacity in Government ordnance factories should be utilized for the manufacture of peacetime explosives, and suggested a five-year production target of 80,000 cwt.

¹ *Reh* is a Hindi word and can best be translated as 'fuller's earth'; the Bengali equivalent is *sajji matti*.

Ammonium Chloride

This is used in several industries (e.g., textiles, rubber, batteries, electrolytic cells) and in soldering, tinning and galvanizing.

Production started on a small scale during the war and has not made much headway, but the installation of a new factory, producing 7,700 tons of ammonium chloride per year, should help to redress matters. The present output is estimated at about 100 tons and consumption at about 1,800 tons per annum. The target is 4,000 tons per year.

Imports in recent years have been : 1948-9, 3,984.55 tons ; 1949-50, 4,246.3 tons ; 1950-1, 1,263.7 tons.

The manufacture in India of ammonium carbonate and bicarbonate used in medicine and baking powders seems desirable.

Potassium Nitrate (Saltpetre)

Potassium nitrate is used mostly in the manufacture of explosives (gunpowder), sulphuric acid and fertilizers. It is extracted from the soil. There are extensive deposits in Madras and Uttar Pradesh.

Production in undivided India was estimated at 10,500 tons per annum. Present production is estimated at about 5,000 tons. The Heavy Chemicals Panel was of the opinion that if the industry was properly organized it could meet the national requirements in full.

Ammonia

This chemical forms the base for the manufacture of ammonium sulphate (fertilizer) and many other useful salts. Refrigeration is another important use.

Ammonia is produced in many ways. The cheapest process, it appears, is by recovery from coal. Although this has been attempted in a few places in India, progress has been little. There are also the electrolytic and the water gas methods. Experiments in these, it is understood, are under way.

Production of synthetic ammonia in 1946 was about 1,500 tons. The more important producing units are at Alwaye and Belagula. The target is 12,000-15,000 tons per annum.

The present consumption is estimated at 2,000 tons per annum.

Imports pre-war averaged 150 tons of which a considerable quantity was utilized by the refrigeration industry.

*Other Organic Substances**Alcohol*

Alcohol is of wide commercial and industrial utility. It is used as a beverage, as a solvent in the paints industry, and as an ingredient in

perfumery, toilet articles, spirit varnishes and pharmaceuticals. Ethyl alcohol is used in the manufacture of chloroform. Denatured spirit serves a variety of purposes, and latterly power alcohol has been increasingly used as motor fuel.

Molasses form the base for manufacture. There have been distilleries in India for many years. The bulk of the production has been potable alcohol. The war gave an impetus to the industry. More factories sprang up, and production of rectified spirit rose from 48,74,000 l.p.¹ gallons in 1938-9 to 1,62,36,000 l.p. gallons in 1943-4. The table below shows production of alcohol and its by-products during recent years :

Production in thousand bulk gallons

	Power Alcohol	Rectified Spirit	Denatured Spirit
1950	4,497.6	3,435.6	1,477.2
1951	5,809.2	5,010.0	1,966.8
1952	7,742.4	4,632.0	2,148.0
1953	7,777.6	4,026.0	2,238.0

There were 53 distilleries and breweries in India in 1947. The number has since increased. The present total productive capital invested in the industry is estimated at Rs 2,49,75,513. The progress of the alcohol industry is dependent largely on the Government's prohibition policy and on the pace of general industrial development. Although at present production is short of installed capacity, prospects are promising. Indeed, exports might be possible. Many distilleries are producing ethyl alcohol in sufficient quantity to meet the domestic demand.

The manufacture of power alcohol is another chemical industry sought to be substantially developed during the Plan period, utilizing an important by-product of the sugar industry. Absorption by industries producing acetone, acetic acid, calcium lactate and chloral hydrate is as yet inadequate ; only a fraction of total availability. The sale of molasses has been so arranged as to facilitate production and enable manufacturers to market power alcohol at controlled rates. Certain State Governments have enacted Molasses Control Acts for the purpose. Capacity is expected to advance by about 40 per cent (from 15 million gallons to 21 million gallons) and production, from 8 million gallons to 18 million gallons.

¹ l.p.: *London proof*, i.e. the strength as ascertained by means of Sykes' Hydrometer. The spirit at a temperature of 51°F. weighs exactly 12/13th part of an equal measure of distilled water.

Inclusive of the cost of facilities to be created for petrol alcohol mixture, this development programme is estimated to cost about Rs 1.20 crores. Larger output of power alcohol is not the only objective. Increase in the installed capacity and production of commercial spirit is also contemplated. Capacity is expected to advance to 3 million gallons and actual production to 2 millions. Even so, full absorption of molasses will not have been achieved. Other uses have to be found. The Central Laboratories for Scientific and Industrial Research, Hyderabad, are reported to have evolved a method for obtaining levulinic acid from molasses. The acid is the basic raw material for a large number of organic compounds of commercial value.

Acetic Acid is used in the manufacture of white lead, rubber, rayon and in the preparation of a number of chemical compounds.

There is only one plant in India. Requirements have mostly been imported. Figures for recent years are: 1945-6, 332.85 tons; 1946-7, 348.65 tons; 1947-8, 2,039.25 tons; 1948-9, 409.20 tons; 1949-50, 500.45 tons; 1950-1, 886.50 tons; 1951-2, 1,312.8 tons and 1952-3, 887.3 tons. Sources of supply have in the main been Britain, the U.S.A. and Canada. The present annual consumption is estimated at about 1,000 tons.

The State is assisting the growth of this industry.

Lead Acetate is used mostly in the paint industry and, to some extent, in the textile industry. Before World War II, requirements were met largely from imports, which averaged 80 tons per annum. During the war attempts were made to produce it in this country. A few factories were established and the industry has now expanded sufficiently to warrant hopes of early self-sufficiency. Imports in 1949-50 were only about half a ton; in 1950-1, about 15 tons; in 1951-2, about 8 tons, and in 1952-3, about 5 tons. Production in 1950 amounted to 65 tons. Supply of raw materials seems to be the main difficulty. Were this overcome, the industry could look forward to a bright future.

The greater part of the production of *Calcium Acetate* is taken by the Government of India for the preparation of acetone, of which about 900 tons are required per year. At present acetone is being prepared from ethyl alcohol. New processes of production are being evolved.

Sodium Acetate is used in dyeing; also in the tanning and soap industries. Small quantities are being produced in various parts of the country. Production is irregular and unorganized.

Glycerine

Glycerine is a by-product of the soap industry and used mostly in the manufacture of pharmaceuticals, cosmetics, explosives (nitroglycerine) and textiles.

There are now six units in operation. Most are in Western India. Present installed capacity is estimated at about 3,500 tons.

Consumption pre-war was about 850 tons per annum. The soap industry produced on an average 650-700 tons and about 150 tons were imported. By 1946 production had increased to 2,500 tons per annum and was enough to meet all internal needs at the time. In 1948 2,142 tons were produced ; in 1949, 1,737 tons ; in 1950, 1,876 tons ; and in 1951, 2,424 tons.

The situation in the two subsequent years is summarized below :

	Number of Units	1952 Installed Capacity (Tons)	Production (Tons)	Number of Units	1953 Installed Capacity (Tons)	Production (Tons)
Glycerine (crude)	7	7,200	5,150	9	7,675	5,200
Glycerine (refined)	6	3,500	2,220	6	3,500	2,225

Production can be increased by installing more plant in soap factories for recovery of glycerine from the spent lye. Action by the industry on a co-operative basis would yield very beneficial results. The soap industry in India is vast and thriving. Large quantities of glycerine could be recovered. Apart from any possible increase in defence needs, large supplies seem likely to be needed in the near future for the manufacture of explosives, and construction of dams, bridges and highways as part of the general development programme.

The balance of production after meeting indigenous requirements is exported. About 3,000 tons were exported in 1952-3. There have latterly been increasing demands from the U.S.A. for this commodity.

A glycerine plant valued at Rs 69,001 has been allotted to India as part of war reparations from Germany. It is meant for vacuum distillation of raw glycerine whereby pure glycerine suitable for nitration is produced. It is capable of producing 80 tons of pure glycerine per month.

Welding Gases

Oxygen and dissolved acetylene are used in welding. There are now two units producing these gases. Oxygen is compressed into cylinders and sold as such for oxy-acetylene welding. Total monthly production capacity increased from 14.7 million c.ft. of oxygen in 1948 to 20 million c.ft. in 1950 ; and from 2.5 million c.ft. of dissolved acetylene in 1948 to 4.8 million c.ft. in 1950. In 1937 production of oxygen was about 22 million c.ft. By 1942 it had increased to nearly 53 million c.ft. Production during recent years has been :

1948, 71.97 million c.ft. ; 1949, 114.94 million c.ft. ; 1950, 132.75 million c.ft. ; 1951, 145.5 million c.ft. ; 1952, 162.6 million c.ft. ; and 1953, 188.1 million c.ft. The figures for dissolved acetylene are : 1948, 17.77 million c.ft. ; 1949, 21.58 million c.ft. ; 1950, 26.37 million c.ft. ; 1951, 29.88 million c.ft. ; 1952, 31.56 million c.ft. ; and 1953, 34.68 million c.ft.

Hydrogen is chiefly used for the hydrogenation of oils. Statistics of present production are not available.

Carbon Dioxide is used mostly in the manufacture of aerated waters and fire extinguishers, in sugar refining and as a refrigerant. Present production is estimated at 12 million lb. Indian resources are adequate and production is reported to be satisfactory.

Coal Distillation Products

From coal distillation are derived naphthalene, phenol, cresols, benzene and toluene. The last two are solvents. There is also solvent naphtha.

Naphthalene is a powerful insecticide and moth repellent. It is used in the form of flakes for the preservation of hides and skins. Production in 1953 amounted to about 550 tons. The present rate of annual consumption is estimated at about 800 tons. Based on availability of about 90,000 tons of coal, potential output works out to 3,600 tons per annum. Annual imports, pre-war, averaged 500 tons. Post-war imports fell from 217.45 tons in 1945-6 to 79.5 tons in 1949-50. The figure for 1950-1 was only 19.15 tons, there were no imports in 1951-2, and in 1952-3 19.4 tons were imported.

Phenol is necessary for the manufacture of several pharmaceuticals, antiseptics and dyes. Production during the war averaged 50 tons per annum. In 1950, only about 7 tons were produced. The present rate of consumption is assessed at 500 tons per year. The potential recovery from 90,000 tons of coal is 140 tons. This is inadequate ; and it seems that the larger part of demand will have to be met from synthetic production.

Cresols

These provide a most effective wood preservative.

In 1946 about 5,00,000 gallons of heavy creosote oil were produced. Production during the war averaged 100 tons per annum. A large part of it was used on wartime hutments. By 1942, the rate of production had risen to 3,500 tons per annum. There are five units in operation. Their capacity has not yet been assessed. Production of light creosote in 1953 and 1954 was (in gallons) 2,00,560 and 4,32,727 respectively.

Benzene

Benzene is the raw material for the manufacture of intermediaries for dyestuffs and pharmaceuticals. It is also used as a solvent for paints, varnishes, and polishes. Waterproofing solutions are also prepared from benzene. Benzol, mixed with petrol, is used as motor fuel.

About 2.4 million tons of benzene were produced in 1946. Subjoined is a summary of capacity and production in recent years:

	Year	No. of units	Annual capacity (Gallons)	Production (Gallons)
Benzene	1953	2	88,500	49,939
	1954	2	88,500	68,799
Benzol	1953	4	18,89,000	13,30,983
	1954	4	18,89,000	12,46,560

Just enough appears to have been produced to meet requirements. Potential output is put at 1.83 million gallons.

A by-product plant for the manufacture of benzol, benzene, naphthalene and tar has been built at Sindri.

Toluene

This is used in the manufacture of explosives, pharmaceuticals and dyestuffs. There are now three producing units with a total installed capacity of 3,09,500 gallons. Production in recent years has been: 1952, 2,91,700 gallons; and 1953, 2,82,800 gallons.

Consumption during the war was 4,00,000-5,00,000 gallons per annum. The present rate is put at 1,15,000 gallons.

Other Inorganic Chemicals

Phosphorus is used mostly in the match industry, in the preparation of war chemicals, and to some extent in metallurgy (e.g. phosphor tin, phosphor copper).

There is no production in India.

Imports, pre-war, averaged 100 tons per year. During the war, the Defence Department's annual demand averaged 700 tons. The present annual consumption by the match industry is estimated at 150 tons and is expected to increase. The present total consumption is estimated at about 300 tons.

Calcium Carbide is used in the manufacture of sodium cyanide, the processing material for gold-refining. In some countries, it is used as

a raw material for synthetic rubber and plastics. In India, the chemical is used mostly for the generation of acetylene. The cutting of iron and steel and welding of ferrous and non-ferrous metals are done by oxy-acetylene flame.

Imports, pre-war, averaged 3,500 tons per annum. During the war about 7,000 tons per year were being imported. There is no production in India yet. The low quality of the coke available seems to be the main impediment to manufacture. Attempts are being made to overcome this. The target is 7,000 tons per annum, which represents requirements.

Magnesia is used mostly in the manufacture of refractories. There are proved deposits of magnesite in Mysore and Madras. Present production is estimated at about 1,000 tons per year. Imports have been of the order of 500 to 600 tons per annum.

Arsenic Oxide is used chiefly as an insecticide and is mostly imported. Imports, pre-war, averaged 250 tons. Imports of arsenic and oxides (in cwt.) during the last few years have been: 1948-9, 2,339; 1949-50, 846; 1950-1, 1,252; 1951-2, 3,961 and 1952-3, 1,990.

Borax is used in the manufacture of glass and for medicinal purposes. It is used also as an insecticide. Production in India is negligible. Imports have been about 1,500 tons per annum. Deposits of borax have been reported in Ladakh (Kashmir) and on the Indo-Tibetan frontier. Geologic investigations are contemplated.

Bichromates

Bichromates of sodium and potassium are used for a variety of purposes, the more important being khaki dyeing, chrome tanning of leather, preparation of pigments for the paints industry and chemical bleaching of some oils and fats. Potassium bichromate is used in the match industry. Chromic acid is essential for electro-plating.

There was little production in India before the war. Requirements were mostly imported. About 275 tons of potassium bichromate and about 1,040 tons of sodium bichromate were imported in 1937-8. Total demand in India during the war averaged 6,000 tons per annum, and to meet this demand plant was installed in Madras, Mysore, U.P., Bombay, Calcutta, Nagpur and elsewhere. But owing to lack of proper facilities for transport of coal, sulphuric acid, lime, etc., production was only about 3,600 tons per annum. The balance of demand was met from imports. All supplies, irrespective of origin, were pooled and a uniform rate charged to consumers.

Installed capacity had reached 5,510 tons per annum by 1946 and there appears to have been no appreciable increase since (only about

400 tons). Production was recorded at 2,081 tons in 1946; 2,306 tons in 1947; 2,939 tons in 1948; 1,720 tons in 1949; 1,974 tons in 1950; 3,220 tons in 1951; 1,463 tons in 1952; and 2,343 tons in 1953. There are now in all 9 units in operation. Small quantities (i.e. 25 to 50 tons) of chromic acid are also now being produced by bichromate factories.

Production of bichromates has been much below capacity. The main causes have been the rather disorganized state of the tanning industry, and the decline in the defence offtake as a result of the change in the dyeing process for ordnance requirements. To balance the loss in the internal market, markets have been sought abroad. These efforts have not been altogether successful, for the price to foreign consumers has been relatively high. With restricted production and the increasing cost of raw materials, freight and wages, it has been difficult to make prices competitive.

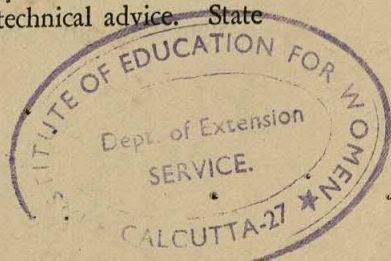
Freight has been costly, and latterly there has been a steep rise in the price of raw materials, chrome ore, soda ash, lime, fuel oil, etc. Moreover, except for sodium sulphate, the industry has no important by-products.

Nevertheless development seems possible. Most of the raw materials required are available in India. The necessary machinery can, it appears, be manufactured in India. Calcutta, Kanpur and Madras have been suggested as suitable centres for new units. With the expansion of the chrome tanning industry, consumption is expected to increase. The State could help by placing its entire demand for khaki cloth for the army and other services with the industry. Indeed, it seems that an export trade in the commodity should be possible were the cost of production brought down to competitive levels. To this task the industry, if it is to survive, must address itself.

Machinery

The manufacture of scientific apparatus and equipment for the chemical industry has made little progress. The absence of constructional materials of the specifications required and dearth of skill—it is a highly specialized task—are the two main limiting factors. Moreover, the market for such goods in India is as yet small; thus, private enterprise is shy. Only elementary and simple needs are being met. Filter presses, tanks, low-pressure vessels, and stirring, mixing and other equipment are manufactured.

The Panel on Industrial Plant and Machinery (Heavy) indicated that there was considerable scope in this country for the manufacture of chemical equipment with the aid of foreign technical advice. State



assistance in the form of bounties, research grants and taxation relief, the Panel added, was necessary. Progress seems possible by expansion of foundries, improvement in the production of castings and standardization. The Ministry of Industry and Supply has prepared a provisional list of chemical machinery and equipment which still needs to be imported.

Labour

The total number of persons employed in 1950 was 33,227. The industry involves processing operations that are often hazardous. It is necessary therefore that in selecting methods of manufacture consideration should be given to the possibility of accidents to and the effect on the health of workers. There are statutory provisions for ensuring safety. But these need to be supplemented by training of labour in the correct methods of handling, transporting and storing. There have been protests from certain sections of the industry against the adoption of ILO standards, which, it is contended, are meant for literate labour in the West. Protests are particularly vehement in respect of wages.

The inability of the industry to bear the burden of higher wages is pleaded. The greatest difficulty is the lack of any objective standard for wages. In the circumstances sufficient inducement to ensure a continuity of labour supply seems a safe criterion. Compared to other industries, however, the number required is small and expenditure on labour consequently negligible.

Of considerable importance to the industry in its present state of development is technical and research staff. Supervision by trained chemical engineers is essential in many processes. Firms in India are now making arrangements for the training of technical personnel in their factories. Some foreign firms are sending their experienced Indian personnel to parent factories for advanced training. Indian students are being sent abroad for post-graduate training in the manufacture and handling of chemicals. Under the scheme for U.S. Technical Aid for India, chemical engineers are included in the second group of experts to be sent here shortly. The bringing into being of a class of skilled workmen is a merit which only a few other industries can share with chemicals. With the expansion now in progress, the industry is likely to provide employment to a much larger proportion than the present 3 per cent of total industrial labour.

General Developments

Production

Significant advances have recently been made in several sectors.

Production of photographic chemicals such as sodium sulphite, thiosulphate and hydroquinone, for instance, is now—thanks to tariff protection—adequate to meet the entire domestic demand.

Calcium carbide, used for making acetylene, was produced for the first time in India in 1952. There are now three units in operation whose total annual capacity is assessed at 5,000 tons. Production in 1954 amounted to 398 tons. Production of benzene hexachloride, an important insecticide (annual capacity, 500 tons) and of rayon grade caustic soda by the mercury cell process (annual capacity 6,000 tons) has begun. Commercial production of ferric chloride in quantities sufficient to meet the entire domestic demand has also commenced. Among minor chemical items produced for the first time in India, mention may be made of medicated soaps and medicated toothpaste.

Among plants under installation is a factory for producing 7,700 tons of ammonium chloride per year, another for phosphoric acid and triple superphosphate, and a third for the manufacture of sulphuric acid by the gypsum process. In addition, two plants for producing glycerine are being set up.

To meet the country's requirements of commercial high explosives—the demand is mainly from the mining industry, irrigation works, road building, etc.—a company to be known as Indian Explosives Ltd. has been formed with an authorized capital of Rs 4 crores. The factory is to be located close to the Bihar coalfields. It is hoped that the output, when the factory is in full production, will be adequate to meet the entire Indian demand for essential commercial high explosives.

Transport

The industry is much exercised over transport. Considerable hardship, it is pointed out, has been caused by high freight rates, inadequate allotment of wagons, lack of special tank wagons, and difficulties over 'small bookings'. In several chemical industries, manufacture is a continuous process. For operations to be economic, a steady and uninterrupted flow of coal supplies is fundamental. This the industry has not been able to secure, in spite of representations. Towards the end of 1952, for instance, the transport position for coal deteriorated greatly. The supply of special wagons for dispatch of soda ash, liquid chlorine and sulphuric acid must, it seems, await better times. A development council for alkali industries has yet to be constituted.

It has been pointed out that the few freight concessions which the Railway Board had agreed to grant for new items are beneficial only up to a point; that the existing rates are more than the industry can reasonably be expected to bear; that retention of or increases

in present freight rates conflicts with the declared policy of Government to fight inflation; and that telescopic rates are of no real advantage to producers. Freight bulks large in the price structure since factories are rarely well situated in respect of both raw materials and markets. The Government's reply is unsympathetic and contains a somewhat pointed reference to the increase in the price of chemicals. In view of the steep rise in the working costs of the railways, the higher charges were, it is argued, inevitable—an argument which the industry has been unable to accept.

Imports

Recent import figures are given below :

Chemicals	1950-1	1951-2	1952-3	1953-4
	Rs 9,16,76,323	19,81,75,411	12,74,46,931	12,72,27,264

The present classification of imports under the heads 'Chemicals, Drugs and Medicines' has caused much confusion. There has been a demand for a detailed scrutiny of the Import Trade Control Schedule to bring it closely into line with the Indian Customs Tariff Schedule. Reports indicate that a re-classification with the object of 'scientific and logical presentation, correlation between statistics of imports and the policy for different items, removing unnecessary distinctions and eliminating ambiguities and including specifically such items which are of importance and are not distinctly shown at present' has been recommended. Implementation is awaited.

The following table summarizes policy in regard to tariff protection :

A. Protection expiring on 31 December 1953

Name of the Industry	Date on which protection was originally granted
Glucose	24-9-1948
Calcium Chloride	18-4-1947
Bichromates	18-4-1947
Oleic and Stearic Acids	24-9-1948
Calcium Lactate	29-3-1951
Hydroquinine	7-3-1952

B. Protection expiring on 31 December 1954

Photographic Chemicals (Sodium Sulphite, Sodium Bisulphite and Sodium Thiosulphate)	18-4-1947
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The industry has asked for the abolition of import duty on raw materials and capital equipment and for a reduction in the rate (it is now 36 per cent) on small machinery and scientific apparatus. The consequent expansion of the industry, it is argued, would within a few years bring in more revenue than the precarious income from an import duty. It is added that in no other country is the import duty on small machinery and scientific apparatus required for research and development so high as in India.

With a view to maintaining continuous production, the Panel on Chemicals has recommended stockpiling of twelve months' requirements of soda ash, caustic soda, rock phosphate, sodium nitrate and potassium chlorate.

Raw materials (e.g. sulphur) are imported largely from the U.S.A., so prices have risen since devaluation. The trend is still upward. The pool price system is a welcome development. Although the balance of advantage is still with the industry, consumers have had no great cause for complaint.

Exports

Exports of chemicals during recent years were valued at : 1952-3, Rs 1,27,84,932 and 1953-4, Rs 1,37,56,870. Production of magnesium chloride, bichromates and glycerine now exceeds home demand. Exports of magnesium chloride were : 1948-9, 3,276.5 tons ; 1949-50, 1,672.1 tons ; 1950-1, 2,002.7 tons ; 1951-2, 1,474.6 tons ; 1952-3, 1,549.8 tons ; and 1953-4, 1,757.25 tons. This commodity has found markets all over the world and earned valuable foreign exchange. In 1950 over 1,000 tons of glycerine were exported. These went mostly to the U.S.A. and earned nearly Rs 34 lakhs for India. Glycerine exports in 1952-3 and 1953-4 have been 159 and 293 tons respectively.

Government Policy

According to the Government of India Industrial Policy Resolution of April 1948, heavy chemicals, fertilizers, and electro-chemical industries are basic industries of importance, the planning and regulation of which by the Central Government is necessary in national interests. The chemical industries are under the purview of the Industries (Development and Regulation) Act. Against this, along with other industries affected, the chemicals industry has protested.

Protests have been directed also against inconsistencies in Government policy, such as the encouragement of production of photographic chemicals at the same time as the imposition of restrictions on the import of raw films, which has affected the demand for such chemicals.

Varying rates of sales tax and excise duty in the States have added to the hardships of chemical and pharmaceutical manufacturers. The industry has asked for centralization of sales tax. The All-India Excise Conference (August 1949) considered that uniformity in excise legislation was imperative and proposed the formation of an expert committee to study the matter. Latest reports indicate that data is being collected to assist the committee in drafting suitable Central legislation. The present state of affairs, if allowed to continue, may affect the location of industrial units. Attempts to achieve uniformity in the rates of sales tax have so far proved abortive. The recommendations of the Taxation Inquiry Commission on the subject are under study.

Controls on caustic soda, soda ash and sulphuric acid are under examination to determine whether they should be abolished or continued under the Industries (Regulation and Development) Act. To the continuance of controls, the industry has had no objection. Only about the methods of administration has there been complaint, the crux of which is that they have been insufficiently effective in all the three phases : production, imports and distribution

To assume from this that the Government has been inactive would be incorrect. A National Chemical Laboratory has been established to undertake research work on development of new industries and to offer advice on improvement to existing manufacturing units.

State assistance has taken several forms. Tariff protection has played a vital role in development. Out of the Rs 21 crores advanced by the Industrial Finance Corporation since its inception, the chemicals industry has so far received Rs 2.44 crores. Response to economic stimuli has been ready and encouraging. Several chemical industries are now on surer ground. Either a rebate on, or exemption from, import duty has been allowed on many important raw materials. Phenol, formaldehyde, hexamine, mineral oils used in the manufacture of insecticides, aluminium fluoride, calcium acetate, gypsum and potassium chlorate are examples. A Development Council has been set up for heavy chemicals : acids and fertilizers. In response to requests from the Indian Chemical Manufacturers' Association arrangements have been made for the training of technical personnel in the private sector in Government research institutions. Hardly less welcome has been the willingness to consider 'grant of emergent licences to manufacturers in addition to their actual users' licences for an amount not exceeding Rs 5,000 each for the importation of raw materials for research and development'.

Taken together, chemical industries have not done badly during the last three years. Indeed, now, some of the production targets fixed by

the Planning Commission seem modest. Output, however, has been generally below capacity. For this several factors have been responsible; over some, such as static demand, the industry has had little control. Emphasis is expected to shift in the second Five-Year Plan from agriculture, irrigation and power generation to fuller industrial development. Referring to chemical industries, Mr. K. C. Reddy, Minister for Production, remarked in Parliament on 9 April 1954 that 'the responsibility for development has been placed on the private sector whose performance would be assessed before any change in policy was contemplated'. Not illogically, the industry regards this as a threat. The level and incidence of taxation and the high freight rates on raw materials and finished products, it contends, weight the scales too heavily against supply of further risk capital. Because of considerable disparity in size, cost of production has varied with each company. Particularly the smaller units have found their obligations to labour and the consumer sometimes difficult to fulfil. In an increasingly competitive market there is obviously a point at which the cost of ignoring cost becomes intolerable. Companies varying in size and structure are adapting their business methods to an environment of increasing economic challenge. To conclude from this that only large organizations can in future play a part in development would be mistaken.

This is the national picture; it may have wide local variations.

CHAPTER XI

THE DRUGS AND PHARMACEUTICALS INDUSTRY

IN two related but quite different respects, the pharmaceuticals industry is important to India; it serves a vital social need and is an industrial asset. Our lives are touched at several points by its products. Adequate and timely supplies may mean to many all the difference between life and death. As an industry, it has, albeit slowly, mitigated the improvidence of imports. Significant advances have recently been made in several sectors; even so, large scope for expansion exists.

The statement opposite summarizes the present situation.

For expansion to be secure, early implementation of the recommendations of the Pharmaceutical Enquiry Committee set up by the Government of India in March 1953 is essential. Reporting in June 1954, the Committee held that the pharmaceutical factories should not content themselves merely with converting bulk pharmaceuticals into dosage form such as tablets, ampoules, compounded preparations etc., but should manufacture as many fine chemicals and drugs as practicable starting from basic chemicals, and intermediates; manufacture should be in quantities sufficient not only to meet their own requirements but also the requirements of as many other processing firms as possible. It recommended that the Government should sponsor the manufacture of fine chemicals and drugs either in the existing Government factories or by setting up new factories wherever private enterprise failed to take up such manufacture.

The manufacturing activities of Government Medical Stores Depots should, the Committee recommended, be reorganized on commercial lines; and the stores activities of these depots should be handed over to the respective State Governments consistent with the commitments of the Centre. The Committee felt that if the State Governments were not in a position to take over, the stores might have to be closed. Mechanization of Government factories on modern lines, and adoption of modern methods of manufacture, were also recommended. Assistance to quinine factories by curtailing the imports of quinine and synthetic anti-malarials and by a levy of customs duty on these products was suggested.

Another suggestion hardly less important was that the penicillin factory at Pimpri should be expanded so that it could produce other antibiotics like streptomycin, chemotherapeutic products like synthetic anti-malarials and sulpha drugs, and vitamins. This was followed by a recommendation that the capacity of the proposed factory should be

SHOWING CAPITAL INVESTED, LABOUR EMPLOYED, VALUE OF RAW MATERIALS
AND SALES IN THE INDIAN PHARMACEUTICAL INDUSTRY

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Type of Factory	No. of Factories	No. of Factories Under the Indian (D. & R.) Act.	Capital Invested	Sale value of Finished Products	Value of Raw Materials consumed in 1952		Labour Employed		Total
					Indigenous	Imported	Technical	Non- Technical	
			Rs.	Rs.	Rs.	Rs.			
A. Public Sector — (i) Major Government Factories	11	7	1,48,14,900	1,16,55,200	45,74,700	14,70,000	181	1,492	1,673
B. Private Sector — (ii) Large-scale private enterprise under foreign control and/or collabora- tion	28	14	6,90,38,390	13,13,49,200	59,72,300	4,17,15,850	354	3,126	*3,480
(iii) Large-scale private enterprise under Indian management	54†	54†	9,25,86,050	13,38,29,473	1,73,05,882	2,23,54,850	1,076	15,896	16,972
(iv) Small-scale private enterprise	1,550	...	6,00,00,000	7,00,00,000	2,50,00,000	70,00,000	1,700	8,300	10,000
TOTAL	1,643	75	23,64,39,340	34,68,13,873	5,28,52,882	7,25,40,700	3,311	28,814	32,125

+ Includes factories with foreign collaboration.

(Source: Indian Chemical Manufacturers' Association).

increased or the private sector should be allowed to manufacture the balance requirements of the country.

The lack of co-ordination between the shark liver oil factories of the Bombay and Madras Governments in their manufacturing and marketing activities was deplored. Adoption of a uniform standard of packing, uniform selling prices and a common brand name for the products marketed was recommended.

The Committee observed that a majority of the firms, including those under foreign control, mainly processed imported bulk pharmaceuticals into compounded preparations, tablets, ointments, injections, etc.; a type of processing which did not involve, in the majority of cases, any special experience or technical skill. These firms should also, the Committee reported, progressively extend their production to include the manufacture of bulk pharmaceuticals, starting from basic chemicals or intermediates as near to the basic chemicals as possible. The expansion should be planned not only to meet their own requirements but also those of other processing firms in the country.

Lack of sufficient demand should not deter firms, the Committee reported, from putting up units for the manufacture of their products within the country. Even if the demand for an essential product was lower than would justify economic production, its manufacture, the Committee added, should be undertaken and Government should give protection to the industry to withstand foreign competition until such time as the demand rose to an economic level.

No new foreign firms, the Committee held, should be allowed to set up factories unless they undertook to manufacture new drugs or those which were not produced in adequate quantities by other factories. The Government, on their part, should not allow a large number of firms to take up the manufacture of the same product; only thus could unhealthy competition be avoided. Based on an analysis of the agreements between certain Indian and foreign firms, and branches or subsidiaries of foreign firms in India and their principals in foreign countries, the Committee reported that those agreements included widely varying terms and that there were no definite guiding principles. It laid down certain broad principles on which foreign participation in the pharmaceutical industry should be encouraged and suggested that the Government should review the existing agreements to bring them into conformity with those principles.

The minimum requirements of premises, equipment and qualified staff for a pharmaceutical factory were also laid down; and it was recommended that the equipment and staff employed by firms should be scrutinized, and that licences granted under the Drugs Act should

be withdrawn if the requirements were not fulfilled within a reasonable time.

In the view of the Committee the working of the patent laws hindered the development of the synthetic drug industry in India. In almost all cases, the Committee pointed out, patents were held by foreign firms who were not willing to allow their patents to be worked in India or were prepared to do so only on payment of heavy royalties. The Government was asked to consider if the International Patent Regulations could be abrogated to enable the manufacturers to make essential pharmaceuticals such as sulphur drugs, vitamins, hormones, etc., without having to pay heavy royalties.

The Committee reported that out of a total of 1,643 pharmaceutical factories in the country, 1,568 were small-scale units, many of them were situated in insanitary places and their equipment was antiquated and inadequate. In most cases, manufacture was not supervised by technically qualified staff and there were no testing laboratories to check the quality of either raw materials or finished products. The Committee recommended that early steps should be taken to cancel the licences and close all pharmaceutical establishments which did not fulfil minimum requirements in premises, equipment and qualified staff. In deserving cases one year's time might be given, the Committee thought, to allow the firms to improve their facilities. A grouping of small-scale factories which did not fulfil requirements, to enable them to pool their resources and put up properly equipped co-operative units, was suggested.

Referring to raw materials, the Committee pointed out that even where resources existed their supply was hampered by lack of proper collection, storage and marketing, and sometimes by excessively rigorous Government control enforced for revenue and other considerations. It recommended the setting up of agencies for the proper collection, storage and marketing of medicinal plants. The Centre and States should, it was added, also encourage cultivation of medicinal plants in a scientific manner and give grants for carrying out experimental work. Another important suggestion was the setting up of an agency for co-ordinating the efforts of the different States and organizations.

The Committee urged the immediate implementation of the recommendations of the Expert Committee on Excise; this was primarily to assist the industry in overcoming the difficulties in securing supplies of ethyl alcohol.

The recommendations included measures to improve the supply of coal-tar products. Principally they were (1) providing sufficient tank wagons for the movement of coal-tar to the distillers; (2) making the recovery of benzol in the coke ovens operated in the country

compulsory unless they were too small for economical recovery; (3) removal of the excise^o duty on benzol; (4) banning the steel companies' existing practice of burning coal-tar in their open-hearth furnaces; and (5) Government sponsorship of the production of those coal-tar chemicals which were not made by the private sector.

The heavy import duty on ethyl alcohol came in for some caustic comment. The Committee recommended the removal of the restrictions on the supply of that commodity; only thus, it was felt, could the development of the synthetic drug industry and research be assured.

Adverting to the supply of animal glands and organs required by the industry, it declared as essential that the recommendations made by the Masani Committee for the improvement of slaughter-houses in Bombay State, particularly those relating to the collection and storage of organs and glands of slaughtered animals, should be enforced in all slaughter-houses in the principal towns throughout the country.

A very useful list of essential drugs—including estimates of demand—whose production should be encouraged was prepared. It was suggested that a more comprehensive one should be drawn up by an expert body of representatives of the medical profession, manufacturers and the Government, and revised from time to time. Possible incentives, such as reduction of the import duty on raw materials, industrial machinery and scientific equipment, were indicated.

The Committee recommended centralization of the administration of the Drugs Act. Control on manufacture, sale and distribution, at present exercised by the State Drugs Controllers, it urged, should be brought under the Drugs Controller (India). A department of Drugs Control should be set up, it added, under the Central Health Ministry.

Particular attention was paid to the need for eradicating the menace of substandard and spurious preparations. Several amendments to the Drugs Act and the Rules thereunder and measures for improving testing facilities were suggested. These included a new definition of the terms 'manufacture' and 'drug'; withdrawal of the provision for the marketing of proprietaries with secret formulae; declaration of offences under the Drugs Act for trading in spurious and substandard drugs as cognizable with deterrent punishment including an adequate fine and a compulsory period of rigorous imprisonment; publicity of the name and address of the offender and cancellation of his trading licence; making possession of spurious drugs an offence under the Drugs Act; deletion of the provision whereby the Drug Inspector has to obtain the permission of a District Magistrate or a Chief Presidency Magistrate before search or seizure of adulterated drugs or drugs carrying a false brand; specification in the Drugs Rules of minimum requirements of premises, equipment and qualified staff, etc.; enhanced

licence fees for the import, manufacture and sale of drugs and pharmaceuticals, and licensing of dealers in crude drugs.

More testing laboratories, it was suggested, should be set up. The Committee recommended the setting up of a Development Council for pharmaceuticals and drugs. Several amendments to the Industries (Development and Regulation) Act to facilitate regulation of the development of small-scale factories and to license production of drugs and pharmaceuticals according to a revised system of grouping were suggested.

The report included recommendations for the expansion and co-ordination of the existing research activities by universities, government institutions and commercial firms. The Committee felt that a large number of new remedies had been rapidly introduced into medical practice and that they reached the market before their effects could be observed. It suggested the appointment of a panel of experts to report periodically on the various drugs. The existing facilities for clinical investigation of new drugs, the Committee urged, should be improved, particularly in Army hospitals, and hospitals attached to medical institutions.

Of special interest to the consumer is the Committee's view that a system of fair trade prices should be enforced under which the retail price of all drugs and medicines should be fixed by an organization representing Government and the trade. In fixing the consumer prices, the discount to the different channels of trade, it was suggested, should be fixed at a reasonable figure.

Mention was also made of the menace of false and unjustifiable claims in advertisements. The Committee observed that the Advertising Bill passed recently would give adequate powers to the authorities to deal with such unsocial practices. It recommended that newspapers, particularly those in Indian languages, should themselves set up a code of advertising which would put an end to suggestive advertisements. If necessary, the Committee added, the State should intervene.

The report emphasized the need for closer cooperation between the medical profession and the industry to create public confidence in the drugs made in the country. One way of achieving it, in the opinion of the Committee, was the setting up jointly of testing laboratories which would undertake the work of certifying the products made by the industry. The Committee confessed to a feeling that the country was flooded by a large number of superfluous preparations, straining the foreign exchange position. It suggested that a list of essential drugs and standard combinations should be drawn up by an expert body, to provide guidance in the production and import of drugs.

In the opinion of the Committee, with the advent of antibiotics and chemotherapeutic products, the medical profession was losing the art

of prescription-writing. It felt that this tendency had largely been responsible for a setback in teaching institutions. If this state of affairs was allowed to continue, it observed, doctors' pharmacies would be reduced to mere selling agencies for prepared drugs.

The dispensing of drugs, the Committee reported, should ordinarily be done by pharmacists. A person should be allowed to enrol either as a pharmacist or as a medical practitioner, but not as both. Medical practitioners may, however, dispense drugs to their own patients. They should, as far as possible, employ qualified persons for dispensing work. The Committee stressed the need for giving the profession of pharmacy a recognized place in society. It suggested upgrading the profession by prescribing suitable courses of study and providing training facilities; a Central Institute of Pharmacy should be set up as well as institutes in each State. The Pharmacy Act, the Committee urged, should be made operative throughout the country.

Rightly the need for co-ordination — a prime factor in promoting efficiency and cost-reduction — received the greatest emphasis. A wide range of activities are involved : co-ordination among producing units, particularly in the pooling of resources ; of the development programmes of firms ; of the efforts of the State Governments, the Indian Council of Agricultural Research and the Council of Scientific and Industrial Research for the cultivation of medicinal plants ; between West Bengal and Bihar in making alcohol more readily available for operations ; within the industry in obtaining requirements of tank wagons for the transport of coal-tar; between the Governments of Bombay and Madras for prescribing proper courses of study and providing training facilities, and in the manufacture and marketing of shark liver oil; in the administration of the Drugs Act and the Industries (Development and Regulation) Act; and between the medical profession and the pharmaceuticals industry in setting up testing laboratories.

The statement below shows the existing capacity for production of some of the essential drugs, the expansion that was likely to be achieved by the end of 1955 and the development that is expected to take place during the second Five-Year period.

Name of Drug	Existing capacity	Capacity at the end of 1955	Target to be attained in the 2nd Five-Year Plan Period (Tentative)
<i>A. Antibiotics</i>			
1. Penicillin	Nil	21.6 million mega units	40 million mega units
2. Streptomycin	Nil	180 Kg.	18,000 Kg.
3. Chloramphenicol (Chloromycetin, Syntomycetin etc.)	3,600 Kg.	3,600 Kg.	10,000 Kg.

Name of Drug	Existing capacity	Capacity at the end of 1955	Target to be attained in the 2nd Five-Year Plan Period (Tentative)
4. Tetracyclins	9,600 Kg. (Aureomycin)	9,600 Kg. (Aureomycin) 2,400 Kg. (Achromycin)	During the Second Five-Year Period expansion of the existing production to include production from basic chemicals is planned.
B. Sulpha Drugs			
5. All varieties	3,51,200 Kg.	4,49,900 Kg.	4,50,000 Kg. Same remarks as in 4.
C. Anti-T.B.			
6. P.A.S.	Nil	36,320 Kg.	1,13,000 Kg.
7. I.N.H.	6,090 Kg.	12,000 Kg.	12,000 Kg. Same remarks as in 4.
D. Anti-Leprosy			
8. D.D.S. & derivatives	2,920 Kg.	2,920 Kg.	11,300 Kg.
E. Synthetic Anti-Malarials			
9. Amidoquin, Chloroquin, Proguanil hydrochloride, etc.	2,000 Kg.	2,000 Kg.	50,000 Kg.
F. Anti-Dysentery Drugs			
10. Iodochlorohydroxyquinoline and Diiodohydroxyquinoline	29,400 Kg.	50,000 Kg.	50,000 Kg. Same remarks as in 4.
G. Anaesthetics			
11. Ether	7,12,350 Kg.	7,12,350 Kg.	No expansion is planned.
12. Chloral hydrate	54,370 Kg.	54,370 Kg.	Do.
13. Ethyl chloride	32,800 Kg.	32,800 Kg.	Do.
14. Chloroform	—	—	75,000 Kg.
15. Procaine hydrochloride	—	—	50,000 Kg.
16. Phenobarbitone	—	—	2,300 Kg.
H. Other Synthetic Drugs			
17. Aspirin	Nil	Nil	1,18,000 Kg.
18. Sodium salicylate	1,25,000 Kg.	1,25,000 Kg.	1,60,000 Kg.
19. Phenacetin	Nil	Nil	53,000 Kg.
20. Bismuth salts	20,000 Kg.	20,000 Kg.	No expansion is planned.
21. Calcium lactate	2,00,000 Kg.	2,00,000 Kg.	Do.
22. Calcium gluconate	60,000 Kg.	60,000 Kg.	Do.
23. Nikethamide	10,000 Kg.	10,000 Kg.	15,000 Kg.
24. Saccharine	25,000 Kg.	80,000 Kg.	91,000 Kg.
25. Arsenicals	2,500 Kg.	2,500 Kg.	2,500 Kg.

Name of Drug	Existing capacity	Capacity at the end of 1955	Target to be attained in the 2nd Five-Year Plan Period. (Tentative)
<i>I. Plant Products</i>			
26. Galenicals (Tinctures, extracts, etc.)	20,00,000 gal.	20,00,000 gal.	No expansion is planned.
27. Quinine	1,00,000 Kg.	1,00,000 Kg.	Do.
28. Strychnine, Brucine	10,000 Kg.	10,000 Kg.	Do.
29. Ephedrine	1,500 Kg.	1,700 Kg.	Do.
30. Caffeine and Salts	5,500 Kg.	6,900 Kg.	Do.
31. Emetine	Nil	Nil	200 Kg.
32. Santonine	250 Kg.	250 Kg.	No expansion is planned.
33. Preparation of Rauwolfia	1,700 Kg.	1,700 Kg.	2,900 Kg.
34. Opium alkaloids	1,400 Kg.	1,400 Kg.	No expansion is planned.
<i>J. Glandular Products</i>			
35. Vaccines (e.g. T.A.B., Cholera, Plague, Anti-rabic and Lymph)	1,100 lakh c.c.	1,120 lakh c.c.	
36. Sera (e.g. Tetanus antitoxin, Diphtheria antitoxin, antivenine, antigas-gangerine)	42 lakh c.c.	46 lakh c.c.	
37. Liver Extract: Oral, Injectable	5,00,000 Kg. 661 lakh c.c.	5,00,000 Kg. 661 lakh c.c.	
<i>K. Insecticides</i>			
38. Pyrethrum extract	60,000 gal.	66,000 gal.	Expansion of production of higher strengths is planned.
39. D.D.T.	7,00,000 Kg.	14,00,000 Kg.	55,00,000 Kg.
40. B.H.C.	20,00,000 Kg.	25,00,000 Kg.	No expansion is planned.
<i>L. Vitamins</i>			
41. Shark Liver oil (Fat-soluble Vitamin A)	70,000 gal. (6,000 i.u.g.)	70,000 gal.	Production of Vitamin A concentrate by molecular distillation is planned.
42. Nicotinic acid and amide	2,030 Kg.	12,000 Kg.	

For development the following factors seem fundamental :

1. extension of resources; development of the fine chemicals industry;
2. co-ordination of activities in, and between, the two sectors, public and private;
3. economic stimuli;
4. improvement in quality; stricter enforcement of the Drugs Act;

5. reduction in price; and
6. expansion of exports.

And these must exist in conjunction for optimum results. Lesser persuasions are of little avail.

Among the several methods suggested for the expansion of the fine chemicals industry the more important are :

1. establishment of chemical industrial corporations;
2. bringing coal-tar intermediates and other raw materials under O.G.L.;
3. either abolition or reduction of the customs duty on coal-tar derivatives and other raw materials; and
4. abolition of the excise duty on solvents and making them more freely available.

Some of these methods are under study; particularly those which suggest correctible handicaps which only the State can help to overcome.

Fine chemicals are handicapped by their dependence on the heavy chemicals industry for raw materials, which have not always been available in adequate quantities. Further, production of fine chemicals calls for technical skill. A high standard of purity has to be maintained. Hence production in present conditions is small. The industry has yet to be developed. Imports bridge the gap between supply and demand. Increase in the Indian output of fine chemicals, and reduction in their price, can come only with either abolition of, or reduction in, the rates of customs and excise duties on raw materials.

A lack of uniformity among the States in the rates of excise duty applicable for the production and use of alcohol has for many years hampered operations. At long last, a bill, based on the recommendations of an expert committee, has been introduced in Parliament to achieve uniformity. With its implementation as a Central Act, the situation should improve.

Another recent welcome development is the appointment of a committee to report on the various problems facing the alcohol industry in India. The terms of reference include the different systems of control in the States over the production, distribution and transportation of alcohol. The Committee is expected to suggest measures which will ensure that while the objectives of control are adequately safeguarded the industrial concerns which need alcohol as a raw material have the minimum of difficulty in meeting their requirements.

The fine chemicals industry has often been confused with the manufacture of pharmaceuticals. They are separate entities; but their

development, in view of their interdependence, must proceed hand in hand.

The pharmaceuticals industry is noticeable not so much for its magnitude — there are much larger industries — as for its recent rapid growth.

The capital invested is assessed at Rs 23.64 crores.

The industry involves a wide range of intricate techniques. The technology represents decades of research and applied science which, although not generally regarded as capital, is none the less one of its most useful forms.

The raw materials can be converted into marketable pharmaceuticals only by a time-consuming process involving not only capital and technology but also a series of less tangible factors such as incentive, competition, etc.

Home capital is not adequately available for efforts the returns on which are long deferred. The industry has not yet attained sufficient size and strength to generate out of its own earnings the additional capital required. Plans for expansion therefore will have to include policies which will set in motion external forces favourable to the industry. Confidence is essential for the transfer of capital to points of application. According to his interpretation of the effects upon the security and profitability of the funds already advanced and those which he may offer for future use, the investor's interest in the industry will wax or wane. In other words, development will depend largely on the preservation of a reasonable profit outlook. A more constructive attitude towards capital, either home or foreign, designed to evoke the best efforts, would go far to ensure vigorous expansion.

A strong trend towards the development of new lines is under way. However, the details and the time schedule are still in a state of flux. Here the incentives need to be especially strong: rewards commensurate with the risks assumed.

All these notwithstanding, expansion will not eventuate without an economic and political setting that will encourage enterprise. Suitable economic conditions have, by and large, been achieved; and further progress is in prospect. As for political conditions, the Industrial Policy resolution of 8 April 1948 is clearly the answer. Subject to operations in some specialized segments, private enterprise has full opportunities for expansion. Indeed, Authority has offered to assist. A development council has been formed. It will no doubt consider, *inter alia*, stimuli capable of setting in motion and sustaining a variety of efforts.

Among possible incentives are a reduction in the railway freight on raw materials, especially those of vegetable origin; classification of plant and equipment as 'capital goods' for calculation of import

duty; abolition of the import duty on scientific and research apparatus; removal of transport restrictions on Indian-made spirituous medicinal preparations; favourable revision of the taxation laws; and restriction of producing units to the present number for so long as current capacity is not fully utilized.

The industry has grown up unplanned; indeed, planning is a relatively recent phenomenon. The factories were built where their product could be sold, so that viewed regionally, there is either an agglutination or an absence of producing units, and a concentration in cities. Hygienic requirements were scarcely considered. Re-location now would be difficult.

*The Location and Number of the Large- and Small-Scale
Pharmaceutical Manufacturing Concerns in India*

	No. of large- scale concerns	No. of small- scale concerns
PART 'A' STATES:	72	1,471.
Assam	—	11
Bihar	1	15
Bombay	35	556
Madhya Pradesh	—	39
Madras	5	130
Orissa	—	1
Punjab	3	37
U.P.	3	143
West Bengal	25	539
PART 'B' STATES:	3	31
Hyderabad	2	4
Madhya Bharat	—	3
Mysore	1	9
Saurashtra	—	9
Travancore-Cochin	—	6
PART 'C' STATES:		64
Ajmer	—	3
Bhopal	—	3
Delhi	—	56
Kutch	—	2
Carried over	75	1,566

Brought forward	75	1,566
OTHER STATES:		2
Jammu & Kashmir	—	2
Total	75	1,568

Source: Report of the Pharmaceutical Inquiry Committee, 1954.

The table above repays study. For one thing, it suggests the nature of the conditions essential to promote manufacture. For another, compared with the number and distribution of units in other fields, it reflects the initial parallelism and subsequent divergence of two industries: the chemicals and the pharmaceuticals.

The units are at various stages of growth, from those highly advanced to those barely getting under way. In consequence, in both size and phase, they are susceptible in differing degrees to the impact of economic forces. The bigger ones are well organized; they present a pattern in which the functions of production, transportation and distribution are joined in an unbroken series; the links cannot be altered without impairing the strength of the chain. While the large units have brought the advantages of massive effort and integration to the problems of carry-through to the markets, the small ones have contributed diversity. Many local merchants perform the retail functions. Thus there has been a commingling of effort.

Structurally, the industry is a mixture of State and private enterprise. Both are subject to a complex system of state regulation; and between them the relationship is obscure and indeterminate. On the pattern of enterprise to be developed, views vary. The divergence however relates largely to means rather than ends. Almost all agree on ultimate objectives; national welfare, advancing living standards and progress. No economic criteria, however, have yet been established to determine the course most likely to lead to the desired goal. State operation of course has many proponents; and has the advantage of conforming to the political convictions of large numbers of people. Given time and favourable conditions, its achievements may be noteworthy. Even so, some doubts obtrude. As a system it possesses certain inherent mechanical and economic drawbacks, which, notwithstanding the knowledge and skill of the managerial personnel, can be overcome only with difficulty. It is slow in application and therefore wastes that invaluable ingredient, time. Hence, unless operations are conducted on a commercial basis, the expected economies may not materialize. The Government Medical Stores

and the Government Opium Factory are instances in point. The enterprise has to be subsidized out of the internal economy. In consequence there is a large avoidable diversion of economic energy worthy of a more rational use. In addition, attempting to develop through an arm of the State involves in some cases the principle of monopoly. While the monopolistic system can achieve results of a sort, competitive activity, if deliberately sought and encouraged, is a dynamic force for which no adequate substitute has yet been found. Moreover, in planning for the future this mixed pattern of governmental and private effort raises difficult problems of adjustment. It is not suggested that there has been an invasion of the private sector, although supplies from Government Medical Stores and Research Institutions to the public and State health insurance organizations have in some measure affected sales. A conscious attempt to enter only fields not yet taken up by private enterprise is discernible. None the less, it involves a responsibility to ensure that the industry's position either at home or abroad is not thereby weakened — the employment of special expedients to acquire quickly capacity equal to requirements may result in the duplication of facilities available — and that there is no squandering of diverted funds on purely short-term objectives. Such considerations — capable of broader application, not merely to the manufacture of pharmaceuticals — must have, it seems in retrospect, governed the Pharmaceutical Enquiry Committee's recommendations. Emphasis on the need for expansion of private enterprise in several spheres — manufacture of penicillin, streptomycin, D.D.T. etc. — runs through the whole Report.

Output has been generally on the increase. As the Union Health Minister remarked in April 1955, 'the supply position in respect of essential drugs is more satisfactory today than it has been for the past sixteen years'. As far as possible, manufacture from a basic material, as apart from mere processing such as tableting, vialling or ampouling, from imported drugs, is being encouraged. Statistics show that annually the sale value of drugs made in India is about 34.7 crores as against imports of Rs 12 to 14 crores. However, there is in production much competitive duplication — a factor to be especially deplored as the field of manufacture is so wide. It is hoped that with the current more intelligent implementation of the powers taken under the Industries (Development and Regulation) Act, the situation will improve. There is growing recognition of the need to take into account existing capacity, the level of demand, and the pattern of development planned before licences are issued for the establishment of new undertakings, the substantial expansion of existing undertakings, and for the manufacture of new articles.

In this exceedingly complex and difficult field of endeavour management requires specialized competence. This industry differs basically

from several others in that it needs to keep pace with a continuous stream of discoveries, not merely with the new methods of economic organization designed to achieve optimum results. Medical science is advancing fast; new drugs are rapidly replacing old ones. Indeed it may soon be necessary to review targets. No underdeveloped country seeking to promote pharmaceuticals production within its borders can rely exclusively on its own efforts for the best results, notwithstanding its increasing competence in the field of industry. Foreign technical and financial assistance seems for some time at any rate fundamental.

Much has been — and perhaps will continue to be — said and written on prejudice against the Indian product. The situation calls for careful and impartial investigation. If doctors continue to prescribe imported drugs, even when these are hard to procure and similar drugs of Indian manufacture are relatively abundant, it is doubtful whether prejudice alone is responsible. Carelessness and dishonesty are nowhere more obviously short-sighted than in this promising industry, whose reputation can only be built up by scrupulous adherence to standards.

In both the public and private sectors funds allotted for research are generally small. In the first, in view of numerous other commitments, larger allotments do not seem possible for some time. In the second, much could be achieved if manufacturers agreed on a co-operative effort and enlisted, if necessary, the assistance of finance corporations. The establishment of joint co-operative drug-testing laboratories is one avenue of advancement. Another is the expansion of the research wings in universities and firms. A third is co-ordination between, as pointed out earlier, the public and private sectors in therapeutic research. Only thus will the discovery of new drugs be possible.

The policy has been to allow only such imports as will supplement, not substitute, home production. Notwithstanding a higher home output, imports in the three years 1952-5 have shown a steady increase; understandably because, consistent with the need for fostering the manufacture of new products through protection, provision had to be made for adequate imports for the implementation of health programmes and of measures for the preservation of cereals and for the control of locusts and other pests.

This policy has been vigorously assailed. That it is still rigid in regard to raw materials; that it has erred on the side of over-liberalization in respect of finished goods; and that it is more geared to the fluctuating foreign exchange position than to the long-term developmental needs of the industry have been the main points of attack. Vindication will involve careful economic and statistical analysis.

Statistics in the pharmaceutical industry are in a deplorable state. Those relating to production and imports present only a part of the

picture. For consumption, there are virtually no figures at all. In the circumstances, an economic analysis is entirely out of the question; even fixing targets for the second five years is liable to a wide margin of error.

Although no satisfactory data are available, demand is doubtless substantial; and is, *pari passu* with the growth in population, increasing. To meet it, the industry is continually engaged in expanding capacity and production and seeking to discover and develop new sources of supply.

Distribution however leaves much to be desired. Abundance and scarcity alternate with areas. As a rule, cities are well served; rural areas are invariably far short of requirements. There is need for more equitable distribution. Both the sectors are equally to blame. Several of the products of Government units are available only in hospitals and aided institutions. Early implementation of the Pharmaceutical Enquiry Committee's recommendation for the introduction of commercial methods of marketing seems essential.

In rural areas in particular sulpha drugs would be invaluable, for they do not need special storage arrangements. In this they have an advantage over penicillin and other antibiotics, whose use, judging from present conditions, seems likely to be confined to urban areas for some years yet.

Compared with the prices prevalent in 1948 and 1949, the present levels clearly represent a reduction; but to be of optimum benefit in view of the continuing poor purchasing power of the people, they will need to fall further, particularly for products in universal use.

By and large, the Drugs Act has been a boon. Understandably, there is a demand for much stricter enforcement. A cess to finance more vigorous policing is a possibility well worth study. Inordinate enthusiasm should not however degenerate into persecution and reduce the social effectiveness of the measures taken; it may interpose an artificial element in the flow of trade.

Export of galenicals (e.g. tinctures and extracts); biologicals (e.g. sera and vaccine) and alkaloids (e.g. strychnine and caffeine), production of which is surplus to requirements, should be stimulated.

There is wide divergence in the quality of crude drugs exported; and trade in this commodity is unorganized. These factors are no doubt transitory, but the effects may be serious. The Medicinal Plants Committee of the Indian Council of Agricultural Research has taken up the question of ensuring a uniform standard of manufacture and sale. The Ministry of Health also has this question under consideration and a comprehensive list of crude drugs whose quality it is desirable to control is being prepared.

Larger exports might have been possible but for the understandable,

if inconvenient, restriction on export of drugs and medicines containing more than 20 per cent of raw materials imported from hard-currency areas, and the unsettled political and economic conditions in some of the importing countries.

Even so exports have been on the increase; supporting, in a way, a rising volume of imports. The bulk of the export trade is with countries in South-East Asia. For the future of these trade channels, India's geographic position is a great advantage; but low producing costs elsewhere could more than offset the transportation differential. The delivered costs will determine the share of the market which competition will award to each source of supply; a factor likely to be ignored because customers in recent years have been easy to find. A buyers' market has now supervened. Evidence is conclusive that for a long time to come competition will be both intensive and extensive, growing though overall requirements may be. Conditions are rapidly developing under which no single exporting nation can hold a preferred position.

As demand expands in this area, India will doubtless be among the chief contestants for the increase. Investment and cost of production will assume a decisive role in determining the rate of expansion. Much will depend upon whether the country maintains a competitive status or permits itself to become a marginal source of supply, subject to the second choice of customers.

Expansion requires constant emphasis on the dual objectives of getting and holding the customer. In this the Government could, in several ways, help. For instance, it could undertake market research and advise industry. Lack of correct information regarding trade regulations in other countries has been a great handicap. Hardly less essential is a workable continuity of tariff policy. Also, exports could be included in trade agreements. All these are only points on the outline, so to speak, of a scheme that could be evolved; in other words, they present the framework into which specific measures could be fitted. Broadly conceived and properly combined, they offer perhaps the best means for maximizing the role of Indian pharmaceuticals in foreign trade.

In view of the diversity of operations and output, it has been necessary here to generalize and there to be specific. For instance, it could be said that the relations between the Government and private enterprise have been, by and large, satisfactory; and, if permitted to run their course, may in fact prove salutary to the country's economy. There is confidence in the future; a factor known to carry development sometimes far beyond normal expectations. Such a situation now exists; and such incentives as the country's economy can afford are in action. No picture of expansion in bold strokes is possible yet, but perhaps it will be permissible a few years hence.

CHAPTER XII^a

FERTILIZERS

To an extent stimulating and at one time appalling, India's sombre food situation emphasizes that the maintenance of a tolerable standard of living will depend primarily on the quantity and quality of food that she can grow at home. Import on the present scale cannot continue indefinitely. For firstly, the increase in world food production in 1950-1 — about 3 per cent over the previous year — measured against world population growth, seems inadequate.

As Mr. Norris Dodd, Director-General of the Food and Agriculture Organization says, there is a real danger that in the formulation of huge defence programmes urgent agricultural requirements may be overlooked. There is general agreement that, in the interests of national economy and security, imports of food must end.

How can inefficiency be reduced and production increased? Among the more important steps, admittedly, will be the utilization to the best advantage of the great reserves of technical knowledge that agricultural science has made available. The more quickly this is done, the less hard will it go with India as a nation.

The most important elements which plants require are nitrogens, phosphorus and potassiums. The artificial fertilizers available for removing nitrogen deficiency are ammonium sulphate, ammonium nitrate in its various forms, and urea. The phosphate deficiency can be corrected by the application of superphosphate. Field experiments in various areas have shown that the use of nitrogenous fertilizers has increased crop yields by 20 to 50 per cent; the percentage has depended upon the type of crop raised. In terms of averages, the response to 20 lb. of nitrogen has been 280 lb. of paddy and 250 lb. of wheat per acre. As regards phosphate, the average response to 20 lb. has been 100 lb. of paddy and 99 lb. of wheat.

According to experts, one maund of urea should produce an increase of 6 maunds of paddy or 5 maunds of wheat, while one maund of ammonium sulphate-nitrate should produce an increase of $3\frac{1}{2}$ maunds of paddy or about 3 maunds of wheat.

Nitrogen requirements vary with the nature of the crop and the soil. A statement is subjoined to show the approximate dosage per acre found suitable for different crops:

<i>Crop</i>	<i>Ammonium Sulphate</i>
Wheat	1.5 to 3 maunds
Rice	1.25 to 2.5 maunds

<i>Crop</i>	<i>Ammonium Sulphate</i>
Maize	3 maunds
Sugarcane	5 to 6.25 maunds
Cotton	2.5 to 3 maunds
Potatoes	5 to 6.25 maunds
Onions	3 to 5 maunds
Other vegetables	3 to 5 maunds
Fodder crops	3 to 4 maunds

(Source: Sindri Fertilizers & Chemicals Ltd.)

India's production of chemical fertilizers has hitherto been small, the principal items being ammonium sulphate and superphosphate.

Ammonium Sulphate

Ammonia lends itself for use as fertilizer in two ways : liquid ammonia can be injected into the soil (a practice widely prevalent in the U.S.A. and Germany); or it can be converted to any of its salts. Ammonium sulphate is the cheapest ammonium salt, widely used all over the world. It is used mostly as a fertilizer — the principal fertilizer used in India — and as a base for the manufacture of a number of other ammonium salts.

Meagre supplies of sulphur and of electric power have in the main hampered progress. To overcome the first handicap, a larger utilization of gypsum for the conversion of ammonia into ammonium sulphate has been suggested. Technical opinion, however, is divided. One section deprecates a greater diversion of gypsum for fertilizer production on the ground that it has more important uses.

The first ammonia synthesis plant installed in India was at Belagula, in Mysore, with a capacity of 6,000 tons per year. Next was a factory in Travancore with a capacity of 50,000 tons per year. It commenced production in June 1949. This unit is unique in that much pioneering effort has gone into evolving a process for the manufacture of ammonia from locally available wood. The Mysore plant now produces about 20 tons and the Travancore one about 150 tons per day. The Sindri plant is one of the largest nitrogen fixation plants in the world, with a capacity of over 1,000 tons of ammonium sulphate per day. The recovery from coal gas is between 25,000 and 30,000 tons per year.

Among the industries which received highest priority in the First Five-Year plan, the fertilizer industry is one of the most important. India's requirements were estimated at 5,00,000 tons of nitrogenous fertilizers and 2,00,000 tons of phosphatic fertilizers. Details of the

expansion contemplated for the nitrogenous fertilizer industry are subjoined :

	1950-1	1955-6
Number of factories	6	7
Annual rated capacity (tons)	78,670	4,81,270
Production (tons)	46,304	4,50,000
Estimated consumption (tons)	2,50,000	6,00,000

At present there are seven plants in the country manufacturing ammonium sulphate. Their rated capacity is 4,26,890 tons. Production in 1952 was about 2,20,300 tons; in 1953 about 3,19,616 tons; and in 1954 about 3,40,222 tons. The Planning Commission estimated that by 1955-6 installed capacity in the private sector would increase to 1,29,000 tons and production to 1,00,000 tons.

Sindri Plant

30 October 1951 was a memorable day in the history of the Indian fertilizer industry. It witnessed the completion of the erection and the commencement of operations of an ammonium sulphate plant at Sindri. The factory celebrated the first anniversary of going into production with a total output of 1,30,993 tons of ammonium sulphate and a daily average of nearly two-thirds of its rated capacity of 1,000 tons per day. Production at Sindri amounted to 1,72,514 tons in 1952; 2,65,704 tons in 1953; and 2,75,029 in 1954. This explains the difference between the overall production figures for 1951 and 1952; 52,705 and 2,20,302 tons. The figure for 1953 (3,15,960 tons) demonstrates a further increase in output. It is interesting to compare the total output in 1954 (3,40,222 tons) with production before Sindri went into operation; in 1950, total output was only about 47,304 tons; in other words, Sindri has stepped up the country's production of ammonium sulphate sevenfold.

In accordance with the Government's policy of running State concerns on commercial lines, a Government-sponsored company with an authorized capital of Rs 30 crores was formed. The Sindri Fertilizers & Chemicals Ltd. was registered on 18 December 1951 as a private limited company with the Registrar of Joint Stock Companies, Bihar. The company took over control on 15 January 1952 of the factory together with its assets and liabilities. Annual turnover was expected to be about Rs 12 crores. There is a Board of Directors, composed of officials and non-officials. The Company will function as an autonomous body, the Government exercising overall control. In many ways the organization seems a wise balance between the need to effect

the greatest possible participation of those in executive charge of the factory in the formulation of policy and the danger of an undue diffusion of responsibility.

The project originated with a recommendation by the Foodgrains Policy Committee in July 1943, that there should be an increase in home production of nitrogenous fertilizers and that, as a first step, immediate action should be taken to start production at the rate of 3,50,000 tons a year. With a world shortage of artificial fertilizers, difficulties over shipping space and a large gap between supply and demand in India at the time — manufacturing capacity was about 40,000 tons per year and annual consumption averaged 2 million tons — that may have seemed an obvious conclusion. But it is not always that an essential need is quickly recognized.

Indirectly perhaps, yet effectively, the recommendation was reinforced a few months later by a resolution of the War Resources Committee of Council that the Government should undertake responsibility for the production of artificial fertilizers as a nationalized industry. Indirectly because, while the Foodgrains Policy Committee had concerned itself solely with possibilities of increasing the country's food production, the War Resources Committee had based its resolution on the need for a heavy chemical industry as a defence potential for the production of munitions.

The Government accepted the recommendation of the Foodgrains Policy Committee. Soon afterwards, consultation with experts in India commenced. Surveys of existing resources of the raw materials, particularly fuel and gypsum, were undertaken. Power supply possibilities were explored. Conferences were held to work out a co-ordinated programme. Discussions showed a divergence of opinion on many points, the more important being the type of fertilizer to be produced, the process of manufacture to be adopted and the location of production. It was decided to invite a technical mission from the United Kingdom to give advice. Imperial Chemical Industries Ltd. offered to assist. The offer was accepted; but it was made clear that acceptance carried no undertaking or guarantee of association with either the building of the factory or its subsequent management. I.C.I. accepted this position.

A technical Mission headed by Mr. G. S. Gowing of I.C.I. Ltd. arrived in India on 10 June 1944. It was met by a consultative committee which had been formed for preliminary discussions and examination of the statistics and information collected to assist in the investigations.

The Mission presented its report to the Government in November 1944. Having fully considered the relative merits of several nitrogenous

fertilizers and probable conditions of storage, transport and application, the Mission recommended the manufacture of sulphate of ammonia. In regard to the process to be employed, after investigating the availability of raw materials and power, the Mission decided that the most economical method of manufacture would be the semi-water-gas process, i.e. employing steam and air in conjunction with coke to produce ammonia, followed by the conversion to sulphate by the gypsum or anhydrite process. In countries rich in sulphur, such as Italy, Japan and America, ammonium sulphate is made by reaction between ammonia and sulphuric acid.

The Mission recommended that coke should be obtained from the Bihar coalfields and gypsum from the Punjab. As raw material would have to be obtained for the most part from Northern India, while consuming areas were widely distributed, it was of the opinion that production should be in a single factory situated in the Gangetic Plain. Of the possible sites in this area it recommended Harduaganj, in Uttar Pradesh, with the alternative of Sindri, in Bihar, a small village on the banks of the Damodar River, about 14 miles down-stream from Dhanbad.

Shortly afterwards, the Government of India accepted the Mission's recommendations. Sindri was selected as the site. For this there were several reasons, the most important being that wagons carrying coal from the Bihar coalfields to the North Punjab could, instead of returning empty, carry back gypsum, effecting considerable economy in transport. Further it was felt that Sindri had greater potential advantages. The establishment of a fertilizer factory there, it was thought, could form the basis of manufacture of a wider range of chemicals, not all of which use gypsum. The site is impressive in its general layout.

On the basis of the Mission's recommendations, the Government of India, in January 1945, sanctioned the negotiation of agreements for the supply of plant and machinery and for the erection of the factory. Two contracts were entered into : one with the Chemical Construction Corporation, an American firm of consulting engineers, to design and erect the factory and see it into production at its rated outturn; and the other with the Power-Gas Corporation, a firm representing a consortium of British chemical plant manufacturers, to arrange the supply of the necessary plant. The agreement with the C.C.C. was signed on 8 February 1946, and that with the P.G.C. on 2 June 1947. It was stipulated that the supply of the major part of the plant should be by competitive tender, and that the resources of Indian industrialists and Indian labour should be fully employed in the supply of such plant and equipment as could be made in India.

Although the agreements were signed in 1946 and 1947, much

preliminary work in the way of survey and purchase of land, levelling of sites and erection of temporary accommodation had been done in 1945. Construction of the factory proper commenced in the middle of 1946. However, difficulties over land acquisition and in obtaining the necessary constructional materials, etc., caused a temporary setback. Towards the beginning of 1948, progress was resumed. By the end of 1950 heavy constructional work on the factory and the associated power house was practically complete. With the exception of the bagging plant, all heavy items of plant and machinery had been installed. Only pipe work, electric cabling and instrumentation remained to be completed. On 20 December 1950, the first boiler in the power plant was fired. On 13 April 1951, the first generator in the gas plant was lit and on 7 November 1951, the last gate of the Gowai Barrage was lowered.

The principal raw materials required are coal for the power house, coke for the generation of gas, and gypsum for the manufacture of ammonium sulphate. To produce about 100 tons of ammonium sulphate about 800 tons of coal, 500 to 600 tons of coke and 1,800 to 2,000 tons of gypsum are required.

The location of the factory near the coalfields has been of considerable advantage. Coal is brought in as required. The boiler house has been planned to operate on second-grade coal. Samples were sent to the U.K. for test. The Coal Commissioner decides on the collieries to be called upon for supply so long as coal control lasts. If controls are removed, supply will probably be by public tender against specification. In order that the factory may start on materials of proved quality, it was decided to use metallurgical coke initially.

There is a coke stockpile of 1,00,000 tons which will last about 170 days of operations. It is hoped that it will soon be possible to develop the coking of second-grade coals. Supplies for the first few years are under negotiation. It seems that the main suppliers can meet only about two-thirds of the factory's requirements and that this supply may not, even at the most liberal computation, last for more than five years. Arrangements for permanent supply have therefore become necessary.

The original intention was to extract about 2,000 tons of gypsum a day from deposits in the Salt Range in the North Punjab. Partition of the country prevented the use of these deposits. Exploration of alternative sources revealed deposits in Bikaner. These are near the surface, can be worked easily and have been found suitable for use. Considerable quantities have been obtained from this source, and have been accumulated on the site. The gypsum storage shed is capable of holding about 90,000 tons or approximately seven weeks' utilization at full out-turn. Arrangements have been made for stockpiling about 60,000 tons of crystalline gypsum and 40,000 tons of non-crystalline gypsum at the

quarry head (Jamsar Mines) in Rajasthan. A field laboratory has been set up at Jamsar to test the quality of gypsum. The project staff includes a Gypsum Development Officer. He is to draw up plans for physical exploration of gypsum deposits and to report on the equipment necessary for developing them. To expedite exploration, the headquarters of this officer were moved to Jodhpur in July 1950.

Deposits in Jodhpur seem promising. Reserves are estimated at about 13 million tons. The Jodhpur Government is willing to lease the deposits to the Central Government. Arrangements were made with the railways for the construction of a transfer station from metre gauge to broad gauge at Agra so as to handle both Bikaner and Jodhpur supplies. Fairly extensive deposits have also been reported in Kathiawar and Kutch.

Recent geological investigations have shown that there is enough gypsum in the country to meet Sindri's requirements for many decades, though transport seems likely to continue to be costly.

The disposal of by-products is important. Calcium carbonate sludge from the gypsum process will build up at the rate of nearly 900 tons per day. This can be used in the manufacture of cement.

Ash from coke and coal, assuming an average of 24 per cent, will involve the disposal of nearly 400 tons of ash per day. The chalk from the gypsum process and ash are now being put in stock in nearby depressions.

Water Supply

About 12 million gallons of water are required daily for the factory and connected activities. It was at one time thought that the Damodar River could be depended on for permanent supply. Expert inquiries qualified this view. It was found that, although there was ample water in the river to meet the factory's daily needs for eight months in the year, for the remaining four the supply might fall considerably below requirements. This necessitated the construction of a riverside intake well and rain-water pump-house and the installation of pumping plant; the installation of a rising main; the construction of a settling tank about 30 acres in area to hold about 90 million gallons of water; the installation of pumping plant at the settling tank and a rising main for drinking water; the construction of two overhead R.C.C. balancing tanks in the township; the construction of a barrage on the Gowai River to create a reservoir to impound 1,000 million gallons of water, and the construction of an infiltration gallery in the Damodar river bed to extract subsurface water.

The barrage is constructed in such a way as to make possible the

building of a bridge later to provide vital communication in those areas which are usually cut off during inundation.

Results from the infiltration gallery have far exceeded expectations. Reserves in the settling tank and the Gowai barrage and supply from the infiltration gallery together furnish a reliable supply. The completion of the Tilaiya Dam under the Damodar Valley Project has given further security. The construction of the infiltration gallery is an experiment which may be of great value not only to India but also to the rest of the world in the problems of extracting water from the deep sands of a river with a seasonal flow.

Machinery

To describe in detail all the items of machinery is impossible here. It must suffice to deal with a few of the more noteworthy features.

The factory's electrical load is about 45,000 kW. A large volume of process steam is also required.

It was originally intended to erect a thermal power station with an installed capacity of about 60,000 kW. When the power house was being planned, it was found that thermal power would need to be generated in the Dhanbad area to supplement the hydro-electric supply from the D.V.C. Since it was an obvious economy to have one power house instead of two, it was decided, in consultation with the Bihar Government, that additional generators should be installed in the factory power house to supply power in bulk to the Bihar grid. The factory now has a power house with an installed capacity of 80,000 kW.

The power-house group consists of the boiler-house building, coal-handling plant (tippler), coal-crusher plant, coal-conveyor plant, auxiliary plant, turbine house, switchgear house and control room, water treatment and clarification plant, water-cooling tower and ash disposal equipment. It forms roughly one-fourth of the factory and is a self-contained unit with the necessary feeder roads and railway facilities. There are six turbines with a total rated capacity of 80,000 kW. Four of them have been commissioned. The other two are ready for commissioning as soon as the load matures. There are six boilers, each capable of producing 1,75,000 lb. of steam per hour of the high pressure of 625 lb. per square inch with a total temperature of 325°F.

The power house is regarded as one of the most modern in the world. It has been designed for extension on the present site up to 1,10,000 kW. installed capacity, and for complete duplication, if necessary.

The gas plant group consists in the main of eight large generators designed to produce 33 million cu. ft. gas per day; plant for handling, crushing and conveying coke, a blower house, two large gas holders

(these were fabricated on the site by riveting), purifier boxes, a booster house, CO conversion plant, CO scrubber plant and a gas plant cooling tower. Five of the generators have been commissioned.

The ammonia synthesis plant group comprises eight giant compressors, each driven by a 2,750 h.p. motor and operating at gas pressures up to 6,000 lb. per square inch, totalling in all a connected load of 20,000 h.p.; two large Horton Spheres each 45 feet in diameter and capable of holding 800 tons of ammonia; five recirculators; and five refrigerators. Four compressors and all the recirculators and refrigerators have been commissioned and are operating as required. The production of anhydrous ammonia started on 28 August 1951 and has continued satisfactorily since its inception.

In the ammonium sulphate group is the plant required for the conversion of ammonia and gypsum to ammonium sulphate. This includes equipment for unloading gypsum (tippler); for grinding and crushing gypsum; and for carbonation, reaction and filtration, evaporation, drying and cooling. There is also a gypsum storage shed, a carbonation cooling tower, a jet condenser cooling tower, miscellaneous cooling towers, and pump houses.

Storage

Last is the storage and packing group. Here provision has been made for the storage of three months' output or 90,000 tons of ammonium sulphate. A building of unique design has been constructed. It is a reinforced concrete parabolic arched silo, with a 150 ft. span, 90 ft. high at the peak of the arch, and 660 ft. long. The entire building is air-conditioned. By means of an overhead conveyor the product can be stocked without manual labour. Similarly, by means of a gathering machine and an underground conveyor, the product can be removed without manual labour. It is said to be one of the largest monolithic reinforced concrete structures in the world.

Ammonium sulphate is made available in bags of two sizes: 2 cwt. and 80 lb. The bagging plant consists of machinery for automatically weighing and bagging 1,000 tons of ammonium sulphate per day and delivery to railway wagons. Bagging involves about 25,000 jute bags per day. A bag store has been built.

About 91,000 yards of reinforced concrete, 11,000 tons of structural steel, 45,000 tons of plant, 80 miles of pipe line, 12 miles of railway track, and 170 miles of electric power-cables were used in construction.

Manufacture

Manufacture is a continuous process. There are three shifts working round the clock. From emptying the wagons of coke, coal and gypsum

up to the packing and sewing of fertilizers, everything is done mechanically or electrically.

The whole factory has been designed in such a way that the out-turn can be doubled by the installation of additional plant while keeping every section correctly placed for the most efficient flow of production. It can also be expanded to produce different types of products such as nitric acid.

In its internal arrangements, the factory is strikingly modern, and working conditions have been transformed to a degree which many would find difficult to imagine. The enterprise provides significant pointers to the future. It may have a marked influence on the diffusion of new techniques throughout industry and thus directly increase national efficiency.

The agreements with the contractors stipulated that as much as possible of the plant required for the factory should be manufactured in India if Indian prices were competitive. It was decided at the outset that all structural steelwork should be fabricated in India from Indian steel. This was done, and much of the simpler plant was also made in India. Practically all cement and reinforcing bars have been supplied from Indian sources.

Certain catalysts are required for coal conversion and for ammonia synthesis. These are at present imported, but as the cost is high, it has been decided to manufacture them in India.

There are proposals for erection of plant for the manufacture of 600 tons of cement per day; 10 tons of urea per day; 10 tons of methanol per day; 8 tons of formaldehyde; and 200-250 tons of soda ash per day; also schemes for the manufacture of ammonium nitrate. These are under consideration by the Government. It is too early yet to count upon any of them making any immediate large-scale contribution towards offsetting the country's shortages. Preliminary studies have, however, indicated the practicability of many of the proposals. In the final analysis it would seem that progress in these directions would be directly proportionate to the amount of finance available.

The transport of some of the heavy and out-of-gauge machinery presented many problems. The size and weight of many imported components called for special measures. Some items of equipment had to be taken by the river canal route to Patna and thence to Sindri by the 'ghat' roads. But for the co-operation of the railways, the Port Trust and the Central Waterways, Irrigation and Navigation Commission (CWINC), the task would have been almost impossible.

Connecting the site with the existing main E. I. Railway line entailed the construction of additional track. The total length of railway line in the factory including the marshalling yard is about 12 miles. The mar-

shalling yard will have to handle six inward and six outward trains daily when the factory is in full production.

Construction

The preparation of the factory site involved the levelling and grading of the ground and the building of factory roads. On the constructional side, it meant the installation of reinforced concrete foundations for buildings and plant; the erection of a maintenance workshop and warehouse — two large steel-framed buildings — and the installation of all ancillary plant (e.g. cranes) as well as the building of a factory administrative office. Laboratories are temporarily housed in a wing of the administrative office.

Constructional work was not confined to the factory. The staff had to be housed and provided with recreational facilities. A town for 4,000 people had to be built. Roads had to be laid. Arrangements had to be made for a piped water supply and sewage disposal. Equipment for electric supply and other services had to be installed.

The water supply system falls into two groups: (a) process water, fire and sanitary supply, and (b) drinking water. Instead of the expensive central disposal installation, as a measure of economy a number of septic tanks have been installed for sewage. As violent electric storms are common in the Sindri area, it was decided that electrical distribution should be mainly by underground cables.

The town may be divided broadly into the following sections: the gazetted staff area; non-gazetted staff area; workmen's area; recreational club; workmen's canteen and club, and the market area. There are eight staff bungalows and a double-storeyed hostel for gazetted staff; twenty austerity-type bungalows, a hostel and Nissen huts for non-gazetted staff; and quarters for married and unmarried workmen. As markets, 50 covered and 70 uncovered platforms have been constructed in the permanent residential colony. A co-operative store of the hut type has been set up.

It was originally proposed to build a 100-bed hospital complete with an administrative block, X-ray room, operating theatre, etc. In view of present high costs of construction, it was later decided to build a 20-bed hospital only, leaving room for expansion.

A plot of land is to be leased for the construction of a cinema. A temporary post office has been established in the permanent residential colony at Saharpura and the temporary post office at Domgarh has been converted into a combined post and telegraph office. It is proposed to construct a double-storeyed building for the post office. Plans for the construction of a police station and other outposts have been prepared. The Government's sanction has been sought for the construction of

additional residential accommodation for the permanent staff and for the construction of roads where expansion of the township is taking place.

The township and the factory between them cover an area of 5,000 acres. Construction of the township alone cost Rs 179 lakhs. Adequate provision has been made for expansion in a 'master plan'. This, it is felt, will be necessary as more industries grow up around Sindri when cheap electric power becomes available from the nearby multi-purpose Damodar Valley project.

Cost

The Technical Mission prepared estimates of the approximate capital costs of factories for the production of ammonium sulphate of outputs varying from 50,000 to 3,50,000 tons per annum.

These were on the basis of conditions then existing; the Mission stated that 'no attempt had been made to forecast the trend of future changes in price levels'; that the cost shown against each head of the estimate had been based on the best information they had been able to obtain in the case of plant and equipment which would have to be imported from abroad; that ocean and rail freights and port duties at current public rates and customs duty had been calculated at an average rate of 12½ per cent *ad valorem* on the c.i.f. value; that no allowance had been made to cover war risk insurance; and that since the factory would operate continuously for 24 hours a day throughout the year, adequate provision for standby plant had been made.

The Mission's estimate for a single factory with an output of 3,50,000 tons of ammonium sulphate per year located at Sindri was Rs 10.53 crores. A later Government estimate was about Rs 23 crores including the cost of a plant for the manufacture of catalysts, but excluding the cost of such complementary plants as coke ovens, a cement plant, etc.

For this difference several factors were responsible. Chief have been items of expenditure not fully allowed for or not allowed for at all in the Mission estimates and certain additions to the scope of the project. Of the first, the more important were miscellaneous charges for servicing, etc. (Rs 36½ lakhs); engineering and other charges of C.C.C. and P.G.C. (Rs 182 lakhs); the exploration of gypsum deposits in Rajasthan (Rs 27 lakhs); maintenance and running expenses of construction and equipment (Rs 17½ lakhs); establishment charges during the construction period (Rs 91½ lakhs); tools and plant for constructional purposes (Rs 17 lakhs); spares for future maintenance (Rs 32½ lakhs) and Central P.W.D. and Bihar P.W.D. departmental charges at 17½ per cent (Rs 78½ lakhs), totalling in all roughly Rs 483 lakhs.

Additions include the expansion of the power house (extra cost Rs 1.88 crores) and measures to ensure the required water supply (half a crore of rupees). There was also the increase in the cost of plant steel (about 100 per cent), cement (about 71 per cent), labour (about 300 per cent), and customs, shipping, insurance, port dues, railway freight charges (46 per cent) to be reckoned with. Competition between projects for the supply of essential raw materials aggravated the situation. In fairness to the Mission, it must be admitted that most of the items on which initial or additional expenditure had to be incurred could not have been foreseen when the estimates were prepared.

Technical Training

The staff includes Dutchmen, Danes, Canadians, Britons and Americans. These are mainly highly qualified engineers. There are also Pakistanis, Ceylonese and Nepalese. But the great majority are Indian.

When it is remembered, as the Technical Mission said, that most sections of the processes have to be controlled according to the readings of various gauges and meters, it will be appreciated that training, especially for the type of worker with no previous industrial experience, requires careful attention. Instruction in safe methods of working the plant used for processing gases and corrosive chemicals will also be necessary.

Arrangements with the suppliers of the plant provided for the training of personnel. Training schemes have been formulated to find personnel for future needs. It was decided that the Union Public Service Commission should be the channel for recruitment. While many posts can be filled by the recruitment of Indian nationals, subject to overseas training, certain key posts had to be filled in the first instance by recruitment abroad. About 55 Indian nationals were selected initially for permanent appointment. Of these 23 were sent for special training overseas. An apprentice training scheme trains Indian nationals for filling appointments as chargemen and supervisors.

The Bihar Government has established a College of Mechanical and Electrical Engineering on a portion of the factory estate.

For the supply of labour, it was found necessary to enter into a form of 'cost plus' contract with contractors. But every possible care was taken to see that the evils of the contractor system were, if not eliminated, at least mitigated. For instance, strict limits were applied to contractors' overheads and profits. Spinning out work with a view to inflating profits was guarded against. It was arranged that the labour should work under the direct supervision of the chief contractors and that the labour contractor should not be concerned in any way with the execution of the works.

With the establishment of a coke oven plant for the manufacture of 600 tons of coke per day and the utilization of the coke oven gases for the manufacture of urea and ammonium nitrate fertilizers with high nitrogen content, Sindri has become the centre of the heavy chemicals and allied industries. Apart from increasing the output of ammonium sulphate, the coke oven plant yields several by-products (e.g. tar, motor benzol, pure benzene).

The catalyst plant begun in March 1952 has been completed. Pilot production started in October 1953. The coke oven plant went into operation in 1954. The erection of the by-product plant to manufacture benzene, benzol, naphthalene and tar is also proceeding according to schedule. The construction of a cement plant for the production initially of 300 and ultimately of 600 tons of cement per day, using as raw material the 900 tons of calcium carbonate sludge produced by the factory and at present going to waste, has been completed. Research has revealed that the 300-400 tons of coal ash which Sindri produces per day could be used as 'an aggregate in heavyweight concrete in building construction for non-load bearing beams not directly exposed to outside atmosphere'. Profitable use of these wastes should have a most beneficial effect on the cost of ammonium sulphate production. Indeed it is hoped that it will 'put Sindri on a competitive basis with any other producing unit in any other country' (Mr. A. K. Chanda).

True, it took a few years for production to begin—perhaps more time than some might have thought necessary. But it must be remembered that for two years the bright purpose of the plan was darkened by the shadow of economic difficulties; and that in subsequent years the shadow did not lift entirely. The soaring of prices is but a single instance. And it is not unnatural in these difficult times that even minor shortcomings in the financial approach to State schemes should loom unduly large. Difficulties there have been and perhaps there will be. In a way, they are an indication and a test of the Government's resilience.

This brief survey of the materials and methods used in construction is not intended, and must not be allowed, to hide the fact that, however good the design and the materials, the primary aim is to produce a fertilizer and not a wonderful and complex piece of mechanism.

Superphosphates

Superphosphates are the most widely used fertilizers in the world and are said to be the most easily assimilable of all phosphatic fertilizers. They are claimed to be particularly useful in the cultivation of rice, potatoes, sugarcane, tea and rubber. For a considerable time these were manufactured in India by treating bones with acid. Chemical engineers

considered this process wasteful because it eliminated many of the other valuable chemical properties of bones. They advocated the exploitation of rock phosphate deposits found in Trichinopoly, Bihar, Rajasthan and Dehra Dun; and suggested that, until the exploitation of indigenous resources was possible and economic, production should be from imported rock phosphate.

Almost all superphosphates are now being produced from imported mineral phosphates. This has released bones for export; and as importers are mostly in hard-currency areas, valuable foreign exchange is being earned. Latterly, prices of bones have risen as a result of heavy foreign demand. Rock phosphate comes mostly from soft-currency countries.

The manufacture of superphosphates from imported mineral phosphates is a significant development. It foreshadows the early exploitation of home resources of rock phosphate.

Freight on imports of rock phosphates—these have come mostly from North Africa and Egypt—has been heavy. It has affected the cost of production. The trade has not been very successful in its attempts to secure supplies from Christmas, Ocean and Nauru Islands, where deposits of high-grade phosphates have been found. State assistance in securing supplies from these sources seems necessary.

There are now 13 units in operation; total capacity per year is put at about 2,75,510 tons. Although their location suggests concentration on the western side of India, it is not very marked. Overall, it would appear that they are fairly evenly distributed. Yet an attempt at regionalization would not be unwelcome in view of the high freight rates on raw materials and finished products.

There is considerable variation in the cost of production. Varying distances from ports and variations in the size of plants are mainly responsible. The pooling of production and price-fixing have, in the circumstances, been particularly beneficial to the less developed units. A factory with a capacity of 5,000 tons per annum is under present circumstances considered an economic unit. The supply of raw materials and plant facilities are said to be satisfactory. So far, imports of rock phosphate appear to have been easy to get and relatively cheap. There is considerable unutilized capacity in the superphosphate industry. Further, manufacture, does not involve the installation of any special equipment.

Annual production, pre-war, was about 2,000 tons and consumption about 10,000 tons. Installed capacity increased from 75,000 tons in 1948 to 1,93,985 tons in 1953. Production during recent years has been :— 1946, 4,500 tons; 1947, 5,004 tons; 1948, 21,360 tons; 1949, 46,728 tons; 1950, 54,428 tons; 1951, 61,020 tons; 1952, 46,656 tons; 1953, 48,300 tons; and 1954, 1,04,688 tons.

The production of superphosphates is closely linked with that of sulphuric acid. Many of the acid manufacturers also manufacture superphosphates.

The temporary decline in output may in the main be attributed to a shortage of sulphur and a fall in offtake. The industry has been using rock phosphate as raw material, all of which is imported. As mentioned earlier, imports of sulphur improved only towards the end of 1952. This somewhat erratic supply has led to increased efforts at replacing sulphuric acid wherever possible. Alternative methods of producing phosphatic fertilizers which do not involve the use of sulphuric acid are being evolved at the National Chemical Laboratory, Poona. The Indian Institute of Science, Bangalore, is also reported to have worked out a process for converting low-grade phosphatic nodules obtained from the Trichinopoly area into a fertilizer without the use of sulphuric acid. All this notwithstanding, developments in this direction are likely to be slow, for the demand for phosphatic fertilizers has yet to take root.

To three main factors may be traced the fall in offtake : the abolition of the Central Phosphate Pool in August 1952; the refusal of State Governments, on grounds of finance, to buy superphosphates, and the reluctance of farmers to try phosphatic fertilizers. The industry owes its growth to the assurance of a market which the Pool and the Grow More Food campaign have offered. With the end of the Pool, offtake fell and there was a large accumulation of stocks. In consequence, production has had to be limited to a fraction of capacity. Not unexpectedly, there has been a demand for the resuscitation of the Pool and for Government arrangements for the distribution of fertilizers to farmers on a crop credit basis.

The following remarks of Mr. K. C. Reddy, Minister for Production, at the annual general meeting of the Indian Chemical Manufacturers' Association at Calcutta on 30 November 1953 represented the Government reaction :

... The Government are alive to the need for adequate proportions of phosphorus as well as nitrogen as nutrients for our crops. The disbandment of the Superphosphate Pool merely means that the marketing responsibilities have been entrusted to the producers . . . It was under the extraordinary conditions created by the War that Government had to create the Pool, and its disbandment is nothing more than an indication of the return to normal conditions.

The winding up of the Pool has made no difference to the Government of India's policy to encourage the use of superphosphates. Short-term credit facilities which are being given by the

State Governments for sulphate of ammonia are being extended to superphosphates also. The Government have also stopped the imports of superphosphates under the Technical Co-operation Agreement in order that the indigenous industry may have the field fully to itself.'

Unless demand warrants it, increased production would obviously be unwise. Attempts have been, and are being, made to stimulate demand. For instance, the supply of superphosphates has been linked with that of ammonium sulphate. The use of mixed fertilizers is being encouraged. Allotments of ammonium sulphate are conditional on the acceptance of a specific proportion of superphosphates. Propaganda for the increased use of phosphate fertilizers has been suggested. And the Government seems inclined to share in the expenses of such propaganda. The bulk of the expenditure, however, would have to be found — and rightly so — from the profits of the industry.

Continuous propaganda seems the only way of overcoming the reluctance of farmers to try phosphatic fertilizers. In this direction the industry has done very little. In order to survive manufacturers need to take a more active interest in the market. In view of the small size of the units, not many may be able to afford the addition to costs. Co-operative measures seem indicated.

The statement below summarizes the programme of development planned for the phosphatic fertilizer industry :

	1950-1	1955-6
No. of factories	14	17
Annual rated capacity (tons)	1,23,460	2,09,355
Production (tons)	55,089	1,80,000
Consumption (tons)	58,400	2,00,000

Besides ammonium sulphate, there are other nitrogenous fertilizers which have proved their usefulness in other countries but have not been tried on an extensive scale in India. Some of these can be produced even in States where gypsum is either not available or is very expensive, provided other facilities are available.

Urea is one of them. It is sold in the market under the name of Uramax. Another is ammonium chloride.

Ammonium Nitrate

Ammonium nitrate is used in the manufacture of fertilizers and explosives. Production has not yet been attempted in the private sector. Ordnance factories are reported to be producing it according to demands

in India. The technique is said to be involved and difficult, particularly in the production of non-caking and non-hygroscopic material. New processes are under experiment in the U.S.A.

As a fertilizer, ammonium nitrate has an advantage over ammonium sulphate in that no sulphur is required for manufacture. Its suitability to Indian soil needs to be examined. Its suitability as an explosive for industrial (mining and tunnelling) and military purposes is under investigation.

Calcium Nitrate

Calcium nitrate is another valuable fertilizer, production of which has not yet been attempted in India. With the manufacture of synthetic nitric acid, a beginning should be possible.

Ammonium Phosphate

This fertilizer is most important to India because it supplies both nitrogen and phosphorus; and Indian soils are deficient in both.

The production in India of this important fertilizer is negligible — about 100 tons per annum. Any increase would depend on economic production of phosphoric acid.

Imports during the years 1945-50 were: 1945-6, 3,853 tons; 1948-9, 3,984 tons; 1949-50, 16,914 tons. Since 1950-1 there have been no imports.

Potash Fertilizers

In the forms of nitrate, sulphate, chloride and carbonate, potassium is useful as a fertilizer. Potassium nitrate occurs in several parts of India. Unfortunately there has been very little progress in manufacture. The industry needs to be properly organized.

The present consumption of potassium carbonate is about 500 tons per annum, all of which is imported.

The situation is not happy, for there is no production, and supplies from Palestine are hard to get and expensive.

Imports

During World War II fertilizers were under the control of the International Emergency Food Council. A scheme of allocations was in operation. This control ceased from 1 July 1949. There is now State trading in fertilizers. Imports of fertilizers are exclusively on Government account. Stocks, on arrival at ports, are handled by firms appointed annually by the Government as clearing and forwarding agents. The

agents are paid for storing, stacking etc., at rates fixed every year. Indigenous production is purchased by the Government and pooled with imports. Both are sold at a pool price fixed from time to time on a 'no profit, no loss' basis.

India has been importing substantial quantities of artificial fertilizers. By far the largest import is ammonium sulphate. Average imports in the four years 1946 to 1949 were 75 per cent higher than before the war. The United Kingdom supplied all or nearly all the ammonium sulphate in 1946. Since then, there has been a rapid decline in imports from that country. Special arrangements were made in 1949 for the import of about 4,00,000 tons of ammonium sulphate for delivery during the two years 1949-50 to meet the requirements of the Grow More Food campaign.

The table below shows imports (in '000 tons) of chemical fertilizers into India during the years 1950-3 :

	1953-4	1954-5
Sulphate of ammonia ...	69,525	83
Nitrate of soda ...	1,113	8,450
Urea ...	2,363	1,491
Other nitrogenous materials ...	1,708	17
Superphosphate ...	1,729	—
Ammonium phosphate ...	300	—
Other phosphatic materials ...	42,668	78,683
Muriate of Potash ...	13,409	22,949
Other potassic materials ...	999	9,996
Other fertilizers ...	—	11,486
Total ...	133,814	133,155

Imports have progressively declined. With the manufacture of about 4 lakh tons from the present factories in India, about Rs 10 crores which would otherwise have gone out of the country every year is now retained in India. Sindri itself has produced so far about 11½ lakh tons of fertilizer, equivalent to a saving of about Rs 35 crores in foreign exchange. The price of the fertilizer produced at Sindri is cheaper than that of the imported variety. With a view to developing the Indian industry, imports of superphosphates have been prohibited.

The Government of India has under the Technical Co-operation Agreement with the U.S.A. obtained 14,086 tons of new fertilizers such as urea, ammonium nitrate, etc. These are being tried at different places.

Distribution

While raw materials are mostly obtained in Northern India, consuming areas are inevitably more widely dispersed. The import of ammonium sulphate is at present a monopoly; supplies are distributed by the Ministry of Agriculture through the agency of the State Governments. So long as this monopoly continues, all Sindri's production will be handed over to the Ministry of Agriculture. The monopoly's purpose is to even out the prices of imported and locally produced ammonium sulphate and pass on the benefit to the agriculturists. In periods of shortage, even distribution can be secured as between locality and locality and as between the various Departments of Agriculture, food crops, plantation industries and so forth.

The Central Fertilizer Pool, which is a State trading scheme, has been working since 1943. Its functions are twofold: to ensure an adequate supply of sulphate of ammonia and other chemical fertilizers; and to maximize their utilization. Allocations out of the Central Pool are made to the States for the Grow More Food Campaign and also for commercial crops such as jute, cotton, tea, coffee and rubber. The internal distribution of fertilizers is the concern of the State Governments. Allocations are in turn made to various agencies including co-operative societies and commercial distributors. The Pool is responsible for payment of the price to manufacturers, recovering the amounts from the State Governments. Among the many advantages of this scheme, the more noteworthy are: it has eliminated middlemen's profits and has ensured that fertilizers are made available to State Governments at reasonable prices to enable them to carry out the Grow More Food campaign. Distribution within States, however, has presented some difficulty, occasioned largely by the farmers' inability to pay for supplies. Attempts are being made to overcome this by the issue of State loans to cultivators. Credit facilities are now available through co-operatives and agricultural loans. About Rs 8 crores was allotted to the States in 1953 for giving loans to cultivators for the purchase of fertilizers. These loans can be repaid either in cash or in kind at the end of the crop season. The requisite development of the purchasing power can only be produced by a gradual development of the resources of those areas.

Demand

Much is being done to increase the use of fertilizers. The obvious objective is to add to the country's production. Attempts are being made to combine the use of fertilizers with the Japanese method of cultivation. In 1953, under a Technical Co-operation Agreement with the

U.S.A., the services of a leading authority on soils and fertilizer research were obtained to advise on the organization of research and for demonstrations in the manuring of crops and the use of fertilizers. The conference of representatives of State agriculture departments which met in Delhi in November 1954 was of the view that adequate stocks should be maintained at the distributing centres by securing and/or building adequate godown facilities; and that the Central Government should advance short-term loans to State Governments for the purpose.

Since India exports no chemical fertilizers, it may be assumed that the entire domestic output and imports are consumed in the country; even so, the figure is not high. It is expected to increase fast as the Indian farmer is gradually being awakened to the advantages of modern agricultural methods.

The principal chemical fertilizer consumed is ammonium sulphate. Before the war yearly consumption was about 1,00,000 tons, used mainly for the cultivation of sugarcane. The use of ammonium sulphate, which was not particularly popular a few years ago, has increased as a result of the following measures :

- (a) The issue price of ammonium sulphate has been reduced from about Rs 330 to Rs 290 per ton.
- (b) A system of uniform freight rate has been introduced and ammonium sulphate is now available at Rs 315 per ton at any railhead in the country.
- (c) The distribution charges, which were quite high in some States, have been reduced and an attempt is being made to sell the fertilizer at Rs 345 at the farmer's door.
- (d) If a cultivator cannot pay for the fertilizer in cash, he is allowed to take it on credit and pay for it after the harvest. A sum of Rs 2 crores was provided for this purpose in the Central Budget in 1952-3. This amount was raised to Rs 8 crores in 1953-4 and Rs 10 crores in 1954-5.
- (e) Effective demonstrations and publicity have been carried out by the staff of the Agriculture Departments and by the National Extension Service.

Against about 270,000 tons used in 1950, consumption in 1955 is assessed at 600,000 tons ; an increase of about 122 per cent, and very near the target of 6.1 lakh tons set for 1955-6. Requirements now are the highest recorded and are still growing; it is estimated that Sindri's maximum capacity would meet only one-seventh of the ultimate demand, which is assessed at two to three million tons annually.

Along with the wider use of ammonium sulphate, there has been an increase also in the offtake of other fertilizers. This all-round increase in fertilizer consumption may be attributed, apart from the measures mentioned above, to the cultivation drive launched as a part of the Integrated Agricultural Production programme, the wider adoption of the Japanese method of cultivation, and the gradual shedding of prejudice among Indian peasants against the use of chemical fertilizers.

In terms of fixed nitrogen, consumption by the end of the Second Plan is expected to be about 3,70,000 tons (or about 18,65,000 tons in terms of ammonium sulphate), phased as shown below :

1956-7	1,50,000 tons
1957-8	1,90,000 „
1958-9	2,40,000 „
1959-60	3,00,000 „
1960-1	3,70,000 „

The following figures summarize consumption of superphosphate in the last five years :

1951-2	43,000 tons
1952-3	28,700 „
1953-4	44,489 „
1954-5	104,052 „
1955-6	85,000 „

Manufacturers of superphosphates have protested against the policy of unrestricted use of nitrogen to the exclusion of superphosphate and other inorganic fertilizers ; they have asked for a better balance in fertilizer consumption. Recent reports suggest the formation of a superphosphate pool on the lines of the nitrogen one. The consumption of phosphate fertilizers is only about 30,000 to 40,000 tons per year and has not kept pace with the increases recorded in the use of nitrogenous fertilizers. Greater attention will have to be paid to the use of these fertilizers in the Second Plan. The Planning Commission has fixed a consumption target of 7,20,000 tons for superphosphates for the second five years to be achieved progressively as follows :

1956-7	3,00,000 tons
1957-8	3,60,000 „
1958-9	4,80,000 „
1959-60	6,00,000 „
1960-1	7,20,000 „

Expansion

The total area under cultivation in India is assessed at 200 million

acres. On the basis of data supplied by the Ministry of Food and Agriculture, the Planning Commission estimated that if the arable irrigated lands in the country received an adequate dose of nitrogen the requirements of nitrogenous fertilizers would be 2 million tons of nitrogen per year, equivalent to 10 million tons of ammonium sulphate. Of this, present capacity (about 85,000 tons) is only about $4\frac{1}{2}$ per cent. Clearly therefore if the country is to develop her agricultural potential fully to feed a rapidly growing population, fertilizer production will need to be increased substantially.

With a view to securing a rapid increase in agricultural output, it is felt that, along with irrigation, fertilizer production must be steadily expanded. An increase of 12.64 million tons in food-grains production by 1961 is aimed at : about 20 per cent of this increase is to be achieved by the use of fertilizers. It has been decided to create additional production capacity of about 2.1 lakh tons of nitrogen to cover the deficit.

The Second Five Year plan envisages an almost fourfold increase in the production of nitrogenous fertilizers by the establishment of at least three more factories of roughly the same capacity as Sindri. An allotment of Rs 100 crores has been made for the setting up of these new plants. Besides the factory to be established at Neyveli (South Arcot) — as part of the lignite project — which will produce 70,000 tons of fixed nitrogen per year in the form of urea and ammonium sulphate-nitrate, two more fertilizer factories are proposed to be set up. One of these, to be located at Nangal, will produce nitrolimestone fertilizer corresponding to 70,000 tons of fixed nitrogen per year. The third factory, proposed to be set up at Rourkela, will produce nitrolimestone equivalent to 80,000 tons of fixed nitrogen per year.

A scheme to expand Sindri's production by about 60 per cent is under way. The project, which is estimated to cost over Rs 10 crores, is expected to be completed by the end of 1957. It will result in the production of 70 tons of urea and 400 tons of ammonium sulphate-nitrate (double salt), two new types of nitrogenous fertilizer. The capacity of the Alwaye plant is also being increased. The Mysore Chemicals and Fertilizers have plans for doubling their production. In all, therefore, as a result of the expansion of existing units and the establishment of new ones, the output of nitrogenous fertilizers — in terms of ammonium sulphate — will be increased to 1.6 million tons by the end of the Second Plan period.

Prospects

The Sindri factory is a vital link in the Government of India's policy of increasing the productivity of the land and so augmenting the food supply. The principal aim is the production of fertilizers. Sindri may

also lay the foundation of a heavy chemical industry and so act as a valuable defence potential. This, however, is of less immediate importance. It if helps to meet a basic human need more adequately, it needs no further justification.

As with superphosphates, the fundamental difficulty in the manufacture of ammonium sulphate has been the inadequate supply of sulphur. In view of this and possible increasing difficulties of this nature in future years — world resources of sulphur are not inexhaustible — immediate investigations into the development of processes for utilizing, so far as possible, indigenous raw materials (e.g. sodium sulphate and magnesium sulphate) for the manufacture of ammonium sulphate, detailed prospecting, and an estimate of available reserves of gypsum and pyrites seem essential. Available statistics of reserves suggest the need for careful husbanding of gypsum.

The problem is not merely one of producing fertilizers. It is also one of applying them to increase the productivity of the large majority of small units of an inherently conservative industry. Agriculture in this country is mainly in the hands of millions of peasants cultivating the soil by age-old methods. They are suspicious of new processes. Further, full appreciation of the properties of a new material takes time. Here, it may be said, the second phase of the agricultural battle begins. With patience and perseverance it can also be won.

The use of fertilizers is fundamental to progress in agriculture. Science is continuously making it easier to produce a high-quality product at a moderate cost. The revolutionizing of agriculture by the increased use of modern methods should have revolutionary effects on the nation as a whole.

Distribution has been particularly disappointing in respect of fertilizers. In the case of ammonium sulphate, the Government of India supplies State Governments. Actual distribution to farmers is the sole concern of State Governments, a system which has affinities with the American 'voluntary chain'. By and large, it seems that only by establishing depots, experimental farms and training units in the States, and by a toning up of agricultural departments at the district level can an appreciable increase in offtake be achieved. Enlistment of the assistance of the National Extension Service is another possibility worth exploring. Reports current some time ago that Sindri was rapidly grinding to a halt have proved false. Production was continued even during the dismal days of stock accumulation.

In the case of superphosphates, the Government reluctance to do the selling for the producers is legitimate and understandable. Views necessarily differ as to how conditions can be improved. A proposal actively canvassed is that the Government should co-operate with private

enterprise in special ventures to encourage the use of fertilizers. Another is that there should be a strengthening of the co-operative movement, particularly of the primary societies which are the first and last link in the nexus between the farmer and the manufacturer. The formation of a National Fertilizer Association for 'the wider dissemination of knowledge about fertilizer utilization' is a step in the right direction. Properly run, it may be able to direct the course of development of this important chemical industry along sound and healthy lines.

India has gone some distance in the right direction. If she has been long in getting upon the right road, she ought to advance the more boldly now she has found it.

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